STATE BOARD OF TECHNICAL EDUCATION & TRAINING::AP, VIJAYAWADA

DIPLOMA IN CIVIL ENGINEERING

I YEAR

SURVEYING-I PRACTICE & PLOTTING (C-108)

MANUAL (AS PER C-20 CURRICULUM)

INTRODUCTION

1.0 INTRODUCTION

The Curriculum of Technical Education should invariably provide for knowledge, attitudes and skills required by the technicians /technologists in the country. In this context the laboratory courses form a vital portion in the entire curriculum of technician education. The laboratory courses shall therefore be so designed and delivered that they help the students acquire attitudes and motor skills that are essential to function effectively as technicians/technologists.

The planning, organization and implementation of lab courses need a detailed description of tasks to be performed by the students. Well thought out instructional objectives to a large extent give these descriptions. The analysis of tasks (by identifying the activities the students are expected to do) help prepare the objectives meticulously. In other words the objectives would be clearer, when the task analysis is done to spell out the sub tasks for each objective.

A survey of the practices currently followed in the technical/technician education shows an urgent need to plug in gaps in instructional procedures. The reasons for these gaps are ambiguity in the minds of the teachers regarding tasks to be performed, levels of competency to be achieved by the students and the weightage to be allocated for each task. This aids in scientific design of instructional plan (optimizing the resources, budgeting the time & content).

The task analysis, teaching points and the structured scheme of evaluation are very important in focusing the instruction on specific skill of desired outcome and in evaluating the same. The Instruction and evaluation in Laboratory courses are different from that of cognitive lessons in the sense that adequate importance and hence weightage needs to be given for all three domains of learning viz. cognitive, psychomotor and affective. Since both training and evaluation of traits of affective domain are practically difficult, a few traits (called values) most relevant and essential to occupations/professions after the Course may be identified for the purpose. It is imperative to integrate these values during instruction and evaluation and also overtly notify the same to the students.

A technician, in addition to performing a skill needs to prepare a report of testing that includes the description of procedure, details of measurements made, reasoning based inferences and so on.,. The current practice of record writing has failed to achieve this purpose as most of the time students end up with making copies of available material.

Therefore, for sensitizing the need for the changes in laboratory instruction, the present hand book has been prepared to meet the above requirements. As such the hand book comprises four parts that intend to :

- Present task analysis, teaching points which can be used for effective design of instruction
- provide a scheme of evaluation with rationally allocated weightage to each significant skill component
- offer a set of questions designed at different levels of competencies for assessment enabling the teacher to set the question paper with balanced levels of competencies

- present pre set worksheets that cultivate the habit of systematic recording of observations and writing the technical report.

- Provide all important data related to particular laboratory activity at one point in the form of annexure

1.1. STRUCTURE OF THE BOOK

The hand book is presented in four parts viz., Laboratory sheets, Worksheet, Experimental Methodology and Annexure. The description of each part is given in the following sections

Part I. Laboratory Sheet

The information provided in this part is useful for the teacher for designing the instruction, planning & organization of the experiment and for scientific evaluation of the students. The major features of the Laboratory sheet are further explained below.

1. **Objective**

   It indicates the **Task** to be performed and completed by the student during the specified duration of time.

2. **Task Analysis**

It is the process of identifying the component activities (sub tasks) to be carried out by the student in order to achieve the stipulated objective. As the task analysis aim at fitting the instructional objectives into various classes of behaviour, it would help the teacher to determine any particular type of behaviour the student has learnt / failed to perform.

The task analysis would help the teacher in identifying the specific activities to be performed by the students. This could also be used as some kind of check list to compare with activities planned for the laboratory. Further it would give clue to the teacher to make students think originally & act independently. It includes both psychomotor learning and the related cognitive information and hence the task analysis is presented as Knowledge and skill parts.

A. Knowledge Part: That includes the cognitive aspects of the task.

B. Skill Part: That includes Psychomotor & Affective aspects of the task.

3. **Teaching Points:**

This includes the points based on the SKILL identified with suggested duration for each point and total duration which helps the teacher for the time and content budgeting during instruction.

4. Need and Scope:

The purpose, application and scope of the task to be performed are normally included in this sub section.

5. Planning and Organisation:

It lists actions to be taken to perform various activities and hence useful in planning the instruction and organizing the resources and equipment

6. Scheme of Valuation:

The information provided in this section helps the teacher to devise a tool for rational measurement assessment of the competencies accomplished by the student.

Part II. Work Sheet

It is designed for the student, where in the student enters his personal data of identification, details of the experiment, stepwise procedure, observations made during experiment, a sample calculation, free hand typical graph, graph from experimental data and inference with discussion.

Part III. Experimental Methodology

This section furnishes information with regard to standard procedure to conduct the experiment along with the description of equipment/apparatus and the basic theory/concept involved in the conduct of the experiment. Thus this section is very useful for both teacher and student as well to conduct the experiment systematically. Thus this section is presented in four sub section as described below:

- **Description**

  It gives the detailed description of apparatus / tools / equipment / materials to be used for the task.

- **Theory / Concept**

  It gives the concept of the task to be performed with formulae and units.

- **Procedure**

  It provides the idea of step wise procedure to perform the task.

- **Observation and Calculation**

  It includes sample observation, sample graph, sample calculation for reference

Part IV. Annexure

All important and useful information that may help in accomplishment of tasks like conversion tables for units, technical & scientific data like material properities, standard trend or characteristic curves (graphs) etc are compiled and presented at one place in this section.

1.2. WHO IS TO USE AND HOW TO USE.

The hand book is so designed that it can be beneficially used by different sections of the technical education viz., the teacher, the student, the examiner and the administrator convenient to individual's requirements. A few uses of this hand book each stakeholder could make is outlined in the following sections.

1. Teacher

A. The **laboratory sheet** is designed keeping the teacher in mind for the teacher has key responsibility of imparting the skills to the student and hence the information given in the lab sheets may be useful for planning & organizing the experimental set up and designing an effective instruction. Thus the teacher may

Plan and organize as per *section 4*,

Instruct the students as per *section 2***,**

Demonstrate each sub task as per *section1.B*.and

Evaluate the students as per *section 5***,** according to the level of competency.

Values: The values in a person are an important personality trait that needs to be nurtured in the learning environment. Further it is also a driving component in any individual to deliver the best and hence this component is also included in the evaluation. However only five key dimensions, that are important in the teaching-learning environment, are taken into consideration for nurturing and evaluation. A little information about these five dimensions is given below as a guideline for the teacher while assessing students.

1. Co-operation: It is the voluntary arrangement in which two or more students engage in a mutually beneficial exchange, instead of competition. Cooperation can happen where resources adequate for both students exist or are created by their interaction.

2. Co-ordination: It is the unification, integration, synchronization of the effect of group members so as provide unity of action in the pursuit of common goals. It is an integral element and required in each & every function and at each & every stage & therefore it cannot be separated.

3. Communication; Communication skill is the set of skills that enables a student to convey information so that it is received and understood.

4. Sharing: A part or portion belonging to, distributed to, contributed by, owed by a person or a group **Or** To participate in, use, enjoy or experience jointly or in turns.

s5. Leadership: Students with the following leadership qualities are almost always the ones that rise above the crowd.

1. Trustworthiness: This refers to integrity.

2. Inspiration: Guides, leads and inspiring others to want to participate in the process of moving towards the vision.

3. Self awareness: It is the individual awareness of him or her self – their abilities and the impact that they have on others.

4. Acceptance of responsibility: True leaders are accepting responsibility for all that comes their way and taking ownership and responsibilities for getting things back on track. Blaming, justifying and excuse making just is not in their responsibility.

B. The **Experimental methodology** is designed for both teacher and student. The teacher can refer the experimental methodology for the details of equipment/apparatus/ materials/tools, procedure to be followed, observations to be made, graphs to be drawn and calculations to be done for the task to be performed

2. Student

The Worksheet is designed keeping in view the needs, deficiencies and the adolescent characteristics of the student for student.

The students submit the filled in work sheet given by the teacher on the day of experiment after referring to experimental methodology and listening to instructions of teacher. The design of the worksheet is made user friendly and the contents are so logically sequenced that the student finds it easy to understand and develop the skill of recording and report writing skill. It also helps the student to actively participate in skill learning. More importantly the student gets immediate meaningful feedback of his performance since the competency wise assessment is done and that too on the same day.

3. Examiner

The examiner may find this hand book very useful as Laboratory sheets and Scheme of evaluation provides information with regard to various competencies (skills) the students is expected to acquire during the course of study and the relative weightages of each competency. This information helps him to design a well balance question paper/measurement tool for assessment.

Lab Sheet 2.1.1 Folding and unfolding a chain

Folding and unfolding a chain

OBJECTIVE

To fold and unfold a chain

EQUIPMENT/APPARATUS/RESOURSES

1. Chain
2. Arrows

1. TASK ANALYSIS

A. KNOWLEDGE

Un fastening the strap .
Keeping the brass handles in left hand.
Throwing the folded chain with right hand .
Opening of chain completely by moving forwarding with holding one handle.
Making the links free of kinks or bents with the spreading and throwing chain.
Reading chain links and marking with arrows for required length
Dragging the chain with one handle.
Pulling the chain at middle.
Bringing the two handles to one end.
Folding the chain by pair links from middle of chain alternately with left and right hands
Bringing two handles together and fastening the bunch

B.SKILLS

Category of Skill	Sub task
1. Handling of apparatus	• Carrying chain to the ground • Using arrows to read lenghs using links
2.Manipulation of apparatus	• Unfastening the strap. • Keeping the brass handles and throwing the folded chain. • Opening of chain completely with holding one handle. • Straight Spreading of chain • Reading chain links and marking with arrows for required length • Dragging the chain • Pulling the chain at middle and Bringing the two handles to one end. • Folding the chain by pair of links wise • Bringing two handles together and fastening the bunch
3. Precise operation /activity	• Throwing the folded chain with energy • Opening chain completely and moving forward to spread. • Making the links free of kinks or bents with the spreading and throwing chain to make straight • Dragging the chain with one handle slowly • Folding the chain by pair links from middle of chain alternately with left and right hands carefully

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
1.	Description about folding and unfolding a chain	5
2.	Objective of folding and unfolding a chain	
3.	Types of chains	
4.	Straight Spreading of chain	4
5.	Reading of links	6
6.	Precautions	
	A. Procedural precautions • Care should be taken while throwing chain. • Care should be taken to spread chain straight • Proper care should be taken so that there are no any kinks or bents in links. • Proper care should be taken to fold chain by pair of links wise without slipping	
	Total	15

3. NEED AND SCOPE OF THE EXPERIMENT

FOLDING AN UNFOLDING CHAIN

Folding an unfolding is useful for every activity of survey using chain

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	1. Ground and weather conditions. 2. Links of chain and length of each link for correctness. 3. Bending of any links 4. Loosening of rings
For design of Instruction	Read the teaching points carefully.

5. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Handling of chain
B. folding
C. unfolding</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>4</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>A. Throwing of chain
B. Dragging of chain
C. Pulling of chain</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>A. Making the links free of kinks or bents with the spreading and throwing chain to make straight
B. Commencing from the middle of the chain two pairs of links are to be taken at a time with right hand and placed on left hand alternately in both directions
C. Fastening with leather strap the bunch of links of chain</td><td><table><tr><td>A</td><td>8</td></tr><tr><td>B</td><td>8</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>A. Co-operation
B. Co-ordination
C. Communication
D. Sharing
E. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

6. ASSESSMENT QUESTIONS (Only suggestive)

7. VIVA QUESTIONS

LAB SHEET

PERFORM DIRECT RANGING

OBJECTIVE

Perform direct ranging on level ground and measure the distance between two given stations and record the measurements in the field book

EQUIPMENT/APPARATUS/RESOURSES

1. Ranging rods
2. Chain
3. Arrows
4. Pegs

1. TASK ANALYSIS

B. KNOWLEDGE

Folding and Unfolding the Chain.
Measuring the Distance with Chain.
Fixing of Ranging Rods.
Fixing intermediate points with pegs and Arrows.
Ranging the line suing standard code of signals
Measuring the length.
Recording the measurements in Field book.

B.SKILLS

Category of Skill	Sub task
1. Handling of apparatus	• Carrying Chain and Ranging Rods to the ground • Using arrows to read lenghs using links
2.Manipulation of apparatus	• Folding and Unfolding the Chain • Fixing the Ranging Rods at intermediate points • Fixing Arrows • Measuring the lengths • Recording in Field books
3. Precise operation /activity	• Throwing the folded chain with energy • Making the chain links free of kinks or bents with the spreading and to make the chain straight • Fixing the Ranging Rods Vertically • Ranging the line straight using code of signals • Unfolding the Chain carefully

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
7.	Description about Ranging	5
8.	Types of Ranging and significance	
9.	Types of Ranging rods	
10.	Fixing of Rods vertically	4
11.	Measuring the length and recording in Field book	6
12.	Precautions	
	B. Procedural precautions • Care should be taken while throwing chain and while spread it straight • Proper care should be taken so that the Ranging Rods are fixed vertically • Care should be taken in following code of signals	
	Total	15

3. NEED AND SCOPE OF THE EXPERIMENT

Perform direct ranging on level ground and measure the distance between two given stations and record the measurements in the field book

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	5. Ground and weather conditions. 6. Links of chain and length of each link for correctness, Bending of any links, Loosening of rings 7. Straightness of Ranging Rods 8. Check the sharpness of iron shoe of the Ranging Rods
For design of Instruction	Read the teaching points carefully.

5. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Handling of chain
B. Folding and unfolding
C. Handling of Ranging Rods</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>4</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>A. Throwing, Dragging and Pulling of chain
B. Fixing of Ranging Rods perfectly vertical
C. Ranging the Chain line straight</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>A. Making the links free of kinks or bents with the spreading and throwing chain to make straight
B. Fixing the Rods into ground maintaining their plumb
C. Ranging using code of signals</td><td><table><tr><td>A</td><td>8</td></tr><tr><td>B</td><td>8</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>A. Co-operation
B. Co-ordination
C. Communication
D. Sharing
E. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

8. ASSESSMENT QUESTIONS (Only suggestive)

9. VIVA QUESTIONS

PERFORM INDIRECT RANGING AND MEASURE THE DISTANCE BETWEEN TWO GIVEN STATIONS WHEN A HIGH GROUND INTERVENES TO PREVENT INTERVISIBILITY OF ENDS OF LINE

OBJECTIVE

To perform indirect ranging, to determine the distance between two given stations when a high ground intervenes to prevent indivisibility of ends of line.

EQUIPMENT/APPARATUS/RESOURSES

3. Chain
4. Ranging rods

1. TASK ANALYSIS

C. KNOWLEDGE

- Unfolding the chain
- Use of hand Signals
- Holding Ranging Rods
- Folding the chain

B.SKILLS

category of Skill	Sub task
1. Handling of Apparatus	• Unfolding and folding of chain • Holding the ranging road straight
2.Manipulation of Apparatus	• Giving Hand signals for ranging the survey line • Recording the readings in field book • Measuringthe distance between the points.
3. Precise operation /activity	• Ranging the line • Laying the chain along the ranging line •

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
13.	What is ranging	5
14.	Different methods of ranging	
15.	Code of signals for ranging	
16.	Procedure of Indirect Ranging	6
17.	Measuring the Distance between points	4
	C. Procedural precautions • Care should be taken while holding the ranging rods • Care should be taken while selecting intermediate points • Care should be taken while using hand signal • Care should be taken while measuring the distance	
	Total	15

5. NEED AND SCOPE OF THE EXPERIMENT

RANGING

The process of fixing or establishing intermediate points when the length of survey line to be measured exceeds the chain is known as Ranging.

INDIRECT RANGING

When both ends of the survey line are not indivisible due to high intervening ground, the method resorted for ranging is known as Indirect ranging.

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	9. the chain for its designated length
For design of Instruction	Read the teaching points carefully.

5. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>D. Unfolding and folding of chain
E. Holding the ranging road straight</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>3</td></tr><tr><td>Total</td><td>5</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Ofapparatus</td><td>A. Giving Hand signals for ranging the survey line
B. Recording the readings in field book
C. Measuringthe distance between the points.</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>A. Ranging the line
B. Laying the chain along the ranging line</td><td><table><tr><td>A</td><td>15</td></tr><tr><td>B</td><td>10</td></tr><tr><td>Tot</td><td>25</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>F. Co-operation
G. Co-ordination
H. Communication
I. Sharing
J. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

10. ASSESSMENT QUESTIONS(Only suggestive)

1. Fix intermediate points for ranging
2. Lining the chain
3. Measure the distance

SET OUT A RIGHT ANGLE TO A GIVEN CHAIN LINE BY USING CHAIN ONLY

OBJECTIVE

To perform chain survey, to set out a right angle to a given chain line by using chain only.

EQUIPMENT/APPARATUS/RESOURSES

6. Chain
7. Ranging rods
8. Wooden pegs

1. TASK ANALYSIS

D. KNOWLEDGE

- Unfolding the chain
- Folding the chain
- Pythagoras Theory
- Ranging

B.SKILLS

category of Skill	Sub task
1. Handling of Apparatus	• Unfolding and folding of chain • Holding the ranging road straight
2.Manipulation of Apparatus	• Use of Pythagoras Theory • Counting of links • Stretching the chain
3. Precise operation /activity	• Ranging the line • Setting out point C ,E & D

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
18.	What is survey line	5
19.	Different methods erect perpendicular to the given chain line	
20.	Procedure of 3-4-5 method to erect perpendicular to the given chain line	6
	D. Procedural precautions • Care should be taken while holding the ranging rods • Care should be taken while selecting Pythagorean Triplets • Care should be taken while counting the links	4
	Total	15

9. NEED AND SCOPE OF THE EXPERIMENT

THEORY

In survey work, it is often necessary to set out right angles or perpendicular lines to the given chain line by using chain only without any instruments. Geometrical constructions are used in this method. The 3-4-5 method is one of the methods commonly used. This method is based on Pythagoras Theory. Pythagorean Triplets other than 3, 4&5 can also use in this method.

5. PLANNING AND ORGANIZATION

Action	Activity
Check for	10. the chain for its designated length
For design of Instruction	Read the teaching points carefully.

5. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Unfolding and folding of chain
B. Holding the ranging road straight</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>3</td></tr><tr><td>Total</td><td>5</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Ofapparatus</td><td>A. Use of Pythagoras Theory
B Counting of links
C Stretching the chain</td><td><table><tr><td>A</td><td>5</td></tr><tr><td>B</td><td>5</td></tr><tr><td>C</td><td>5</td></tr><tr><td>Tot</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>A Ranging the line
B Setting out point C ,E & D</td><td><table><tr><td>A</td><td>10</td></tr><tr><td>B</td><td>15</td></tr><tr><td>Tot</td><td>25</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>K. Co-operation
L. Co-ordination
M. Communication
N. Sharing
O. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

LAB SHEET

Setting Perpendicular and Oblique Offsets to Chain line and Measuring them

OBJECTIVE

To Set the perpendicular offsets and oblique offsets to a ranged chain line and simultaneously measure these lengths

EQUIPMENT/APPARATUS/RESOURSES

1.. Chain

2.Tape

3. Ranging roads

4.Wooden cross staff

5.Arrows

1. TASK ANALYSIS

E. KNOWLEDGE

Measuring the Distance with Chain.
Fixing of Ranging Rods.
Knowing the types of offsets and their significance
Using the Cross Staff.
Measuring the offset lengths.
Recording the measurements in Field book.

B.SKILLS

Category of Skill	Sub task
1. Handling of apparatus	• Carrying Chain, Ranging Rods and Cross Staff to the ground • Using arrows to read lenghs using links
2.Manipulation of apparatus	• Folding and Unfolding the Chain • Fixing the Ranging Rods • Holding the Cross Staff • Holding the Tape at required mark • Measuring the lengths • Recording in Field books
3. Precise operation /activity	• Throwing the folded chain with energy • Making the chain links free of kinks or bents with the spreading and to make the chain straight • Fixing the Ranging Rods Vertically

	• Holding the Cross Staff Vertically and looking through its slits

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
21.	Description about Offsets	5
22.	Types of Types of Offsets	
23.	Significance of setting offsets	
24.	Setting of Offsets in the feild	4
25.	Measuring the offset length and recording in Field book	6
26.	Precautions	
	E. Procedural precautions • Care should be taken while throwing chain and while spread it straight • Proper care should be taken so that the Ranging Rods are fixed vertically • Care should be taken in holding the Cross staff at required points • Care should be taken in handling the Tape	
	Total	15

3. NEED AND SCOPE OF THE EXPERIMENT

Perform direct ranging on level ground and measure the distance between two given stations and record the measurements in the field book

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	11. Ground and weather conditions. 12. Links of chain and length of each link for correctness, Bending of any links, Loosening of rings 13. Straightness of Ranging Rods and sharpness of iron shoe of the Ranging Rods 14. Condition of Cross Staff
For design of Instruction	Read the teaching points carefully.

5. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Handling of chain and Tape
B. Handling of Ranging Rods
C. Handling of Cross Staff</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>4</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>A. Throwing, Dragging and Pulling of chain
B. Fixing of Ranging Rods and Cross Staff perfectly vertical
C. Unwinding and winding of Tape</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>A. Making the links free of kinks or bents with the spreading and throwing chain to make straight
B. Fixing the Rods and Cross staff into ground maintaining their plumb
C. Holding the Tape at the correct points</td><td><table><tr><td>A</td><td>8</td></tr><tr><td>B</td><td>8</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>A. Co-operation
B. Co-ordination
C. Communication
D. Sharing
E. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

11. ASSESSMENT QUESTIONS (Only suggestive)

12. VIVA QUESTIONS

Lab Sheet 2.1.6 Setting Perpendicular and Oblique Offsets to Chain line and Measuring them

LAB SHEET

Setting Perpendicular and Oblique Offsets to Chain line and Measuring them

OBJECTIVE

To chain around the building to cover a small area by chain triangulation

EQUIPMENT/APPARATUS/RESOURSES

Chain of 30m/20m	-	1NO
Ranging rods	-	6NO
Tape 30m /20m	-	1no
Arrows	-	10nos
Pegs	-	4nos
Cross staff	-	1no

1. TASK ANALYSIS

F. KNOWLEDGE

Measuring the Distance with Chain.
Ranging of Chain line.
Measuring offsets using the Cross Staff.
Recording the measurements in Field book.
Principles of Chain triangulation

B.SKILLS

Category of Skill	Sub task
1. Handling of apparatus	• Carrying Chain, Ranging Rods and Cross Staff to the ground • Using arrows to read lenghs using links

2.Manipulation of apparatus	• Folding and Unfolding the Chain • Ranging the Chain line • Holding the Cross Staff • Measuring the lengths • Recording in Field books
3. Precise operation /activity	• Selecting Main Survey stations • Selecting subsidiary stations • Establishing Tie lines and Check lines • Fixing the Ranging Rods Vertically • Measuring offsets using cross staff and tape

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
27.	Description about Chain Triangulations	5
28.	Establishing important Stations	
29.	Establishing important Lines (Forming Traingles)	
30.	Chaining around the building	4
31.	Measuring the offset length and recording in Field book	6
32.	Precautions	
	F. Procedural precautions • Care should be taken while throwing chain and while spread it straight • Care should be taken so that the Ranging Rods are fixed vertically • Care should be taken in holding the Cross staff at required points • Care should be taken in handling the Tape • Care should be taken while passing through bushes and thorns and etc	
	Total	15

3. NEED AND SCOPE OF THE EXPERIMENT

To Perform triangulation survey of a given area with chain and cross staff and record all necessary details

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	15. Ground and weather conditions. 16. Links of chain and length of each link for correctness, Bending of any links, Loosening of rings 17. Straightness of Ranging Rods and sharpness of iron shoe of the Ranging Rods 18. Condition of Cross Staff 19. Check for the presence of nails, thorns etc
For design of Instruction	Read the teaching points carefully.

5. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Handling of chain and Tape
B. Handling of Ranging Rods
C. Handling of Cross Staff</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>4</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>A. Throwing, Dragging and Pulling of chain
B. Fixing of Ranging Rods and Cross Staff perfectly vertical
C. Unwinding and winding of Tape</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>A. Making the links free of kinks or bents with the spreading and throwing chain to make straight
B. Fixing the Rods and Cross staff into ground maintaining their plumb
C. Establishing Survey Stations and lines</td><td><table><tr><td>A</td><td>8</td></tr><tr><td>B</td><td>8</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>A. Co-operation
B. Co-ordination
C. Communication
D. Sharing
E. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

13. ASSESSMENT QUESTIONS (Only suggestive)

VIVA QUESTIONS

Lab Sheet 2.1.7 CALCULATE THE AREA BY CHAIN TRIANGULATION

CALCULATE THE AREA BOUNDED BY THE GIVEN POINTS BY CHAIN TRIANGULATION.

OBJECTIVE:

To perform the Calculate the area bounded by the given points by chain Triangulation.

EQUIPMENT/APPARATUS/RESOURSES

1. Chain

2. Tape

3. Ranging rods

4. Arrows

1. TASK ANALYSIS

A. KNOWLEDGE

.Usage of Chain

.Usage of Tape

.Usage of Ranging rods

.Usage of Arrows

B.SKILLS

Category of Skill	Sub task
1.Hadling of apparatus	Using Ranging rods fix at each end of the survey line. Using Tape to measure the offsets. Using Arrows fix into the check line. Using Chain to measure the base line
2.Manipulation of apparatus	Taking measurements accurately. To Locate the boundary lines carefully.
3.Precise	Convert all measurements into single area. Calculating Triangle area. Calculating total field area . Draw the area plotting.

2. TEACHING POINTS

S.NO.	Teaching points	Suggestive Duration (Min)
1.	Description of about Triangle area A. Principle of working from whole to part. B. Methods of determining area.	5
2.	What is area	
3.	Methods of finding out areas	4
4.	Calculating boundary area	
5.	Calculating Triangle area	
6.	Precautions	
	A. Procedural Precautions **.**The Ranging rods should be established correctly **.**The Judgment of line should be taking correctly during established ranging rod at appoint. **.**	6
	Total	15

3. NEED AND SCOPE OF THE EXPERIMENT.

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	1. Working conditions of Chain, Tape 2. Functioning of Chain. Tape 3. Availability of quality of material 4. Survey lines marked on the ground
For design of Instruction	Read the teaching points carefully

5. SCHEME OF EVALUATION

Category of Skill	Sub task	Weight with Competency level individually	Awarded (50)
1.Hadling of apparatus	A. Using Ranging rods fix at each end of the survey line. B. Using Tape to measure the offsets. C. Using Arrows fix into the check line. D. Using Chain to measure the base line	A 3 B 3 C 2 D 2 TOTAL 10	
2.Manipulation of apparatus	A. Taking measurements accurately. B. To Locate the boundary lines carefully.	A B Tot 8 7 15	
3.Precise/operation/ Activity	A. Convert all measurements into single area. B. Calculating Triangle area. C. Calculating total field area . D. Draw the area plotting.	A 3 B 5 C 7 D 5 Total 20	
5. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
	Total	50	

6. ASSESSMENT QUESTIONS(only suggestive)

1. Calculate the boundary area
2. Draw the boundary area

7. VIVA QUESTIONS

1. How to measure the building area
2. What are difference between Chain and Tape
3. What is base line
4. What is Check line
5. How to Calculate the Triangle area
6. How to measure the Triangle area
7. What is Offset

Lab Sheet 2.1.8 CALCULATION OF AREA BY CHAIN AND CROSS STAFF

CALCULATION OF THE AREA BOUNDED BY THE GIVEN POINTS BY CHAIN AND CROSS STAFF

OBJECTIVE:

To perform the Calculate the area bounded by the given points by chain and cross staff

EQUIPMENT/APPARATUS/RESOURSES

1. Chain

2. Tape

3. Ranging rods

4. Arrows

5. Cross Staff

1. TASK ANALYSIS

A. KNOWLEDGE

.Usage of Chain

.Usage of Tape

.Usage of Ranging rods

.Usage of Arrows

.Usage of Cross Staff

B.SKILLS

Category of Skill	Sub task
1.Hadling of apparatus	Using Ranging rods fix at each end of the survey line. Using Tape to measure the offsets. Using Arrows fix into the check line. Using Chain to measure the base line Using Cross Staff to setting out right angles
2.Manipulation of apparatus	Taking measurements accurately. To Locate the boundary lines carefully. Setting out right angles carefully

3.Precise	Convert all measurements into single area. Calculating Triangle area. Calculating total field area . Draw the field plotting.

2. TEACHING POINTS

S.NO.	Teaching points	Suggestive Duration (Min)
1.	Description of about area C. Principle of working from whole to part. D. Methods of determining area.	5
2.	What is area	
3.	Methods of finding out areas	4
4.	Calculating boundary area	
5.	Calculating Triangle area	
6.	Precautions	
	B. Procedural Precautions **.**The Ranging rods should be established correctly **.**The Judgment of line should be taking correctly during established ranging rod at appoint. **.**	6
	Total	15

3. NEED AND SCOPE OF THE EXPERIMENT.

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	6. Working conditions of Chain, Tape, Cross Staff 7. Functioning of Chain. Tape, Cross Staff 8. Availability of quality of equipment 9. Survey lines marked on the ground
For design of Instruction	Read the teaching points carefully

5. SCHEME OF EVALUATION

Category of Skill	Sub task	Weight with Competency level individually	Awarded (50)
1.Hadling of apparatus	A. Using Ranging rods fix at each end of the survey line. B. Using Tape to measure the offsets. C. Using Arrows fix into the check line. D. Using Chain to measure the base line E. Using Cross Staff to setting out right angles	A 3 B 3 C 2 D 2 TOTAL 10	
2.Manipulation of apparatus	A. Taking measurements accurately. B. To Locate the boundary lines carefully. C. Setting out right angles carefully	A B Tot 8 7 15	
3.Precise/operation/ Activity	A. Convert all measurements into single area. B. Calculating Triangle area. C. Calculating total field area . D. Draw the boundary plotting.	A 3 B 5 C 7 D 5 Total 20	
10. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
	Total	50	

6. ASSESSMENT QUESTIONS(only suggestive)

1. Calculate the boundary area by cross staff method
2. Draw the boundary area

7. VIVA QUESTIONS

1. How to measure the Rectangle area ?
2. Distinguish between ranging and indirect ranging
3. What are the duties of leader ?
4. State the equipment used in Chain Surveying
5. What is the formula to Calculate the Triangle area ?
6. State the functions of cross staff
7. What is Offset ?

CARRYING OUT CHAIN SURVEY TO OVERCOME OBSTACLES

OBJECTIVE

To measure the length of obstructing object along the survey line

EQUIPMENT/APPARATUS/RESOURSES

10. Chain
11. Tape
12. Ranging rods
13. Cross staff
14. Arrows
15. Pegs
16. Drawing sheet and drawing instruments

1. TASK ANALYSIS

G. KNOWLEDGE

- Folding, unfolding and spreading of chain
- Reading of chain
- Usage of Tape
- Reading of Tape
- Usage of cross staff
- Measuring length.
- ranging

B.SKILLS

Category of Skill	Sub task
1. Handling of apparatus	• Using chain for measuring length of line on ground • Using tape for measuring length of line on ground • Using cross staff for erecting perpendicular • Driving ranging rods into the ground • Using of drawing instruments
2.Manipulation of apparatus	• Ranging and prolonging a survey line • Measuring length of line on ground using tape and chain • Erecting perpendicular using cross staff • Observing through cross staff and Directing the follower to move accordingly the ranging rod while erecting perpendicular • Following the instruction of surveyor to move accordingly the ranging rod while ranging and erecting perpendicular

3. Precise operation /activity	• Fixing of cross staff accurately on the line with correct view with the help of cross staff head • Directing the follower to move accordingly the ranging rod and in fixing it while ranging and erecting perpendicular (duty of surveyor) • following the instruction of surveyor as per his directions while ranging and erecting perpendicular (duty of follower) • Spreading of chain and reading of links of chain correctly • Spreading and reading of tape properly • Measuring the length of line on ground and recording value • Apply correction to chain/tape necessary • Calculating the obstructing length • Compare results by plotting.

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
33.	Description about measuring length of obstruction/obstacle across the survey line	5
34.	Meaning of obstacle	
35.	Types of obstacles	
36.	Classification of obstacles into different cases	4
37.	Different methods to measure length of obstruction/obstacle	6
38.	Precautions	
	G. Procedural precautions • Care should be taken in erecting perpendicular. • Care should be taken to range/ prolong line accurately • Proper care should be taken in reading tape and chain and in recording the length • Choosing correct scale and accurate drawing while plotting	
	Total	15

3. NEED AND SCOPE OF THE EXPERIMENT

LENGTH OF OBSTACLE:

This measurement is useful for continuing the chaining while surveying.

OBSTACLE

The object across a survey line which creates obstruction and make it not possible to continue the survey line

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	20. Ground and weather conditions. 21. Links of chain and length of each link for correctness. 22. Sagging of Tape if any 23. Loosening of head of cross staff if any. 24. Visibility of numerals on tape
For design of Instruction	Read the teaching points carefully.

5. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>F. Using chain/ tape for measuring length
G. Using ranging rods for ranging/prolonging a line
H. Using cross staff for erecting perpendicular.</td><td><table><tr><td>A</td><td>3</td></tr><tr><td>B</td><td>3</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>D. Measuring length using tape/chain
E. Erecting of perpendicular and Ranging/Prolonging a line
F. Reading values carefully</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>D. Erecting perpendicular
E. Ranging/Prolonging a line
F. Applying appropriate formula to calculate the length of object
G. plotting
H. Compare results in graph by plotting</td><td><table><tr><td>A</td><td>4</td></tr><tr><td>B</td><td>4</td></tr><tr><td>C</td><td>4</td></tr><tr><td>D</td><td>4</td></tr><tr><td>E</td><td>4</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>P. Co-operation
Q. Co-ordination
R. Communication
S. Sharing
T. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

14. ASSESSMENT QUESTIONS (Only suggestive)

4. Measurement of length of required lines
5. Recording observations and applying suitable formulae if necessary.
6. Determining the length of object

15. VIVA QUESTIONS

(Only suggestive) The teacher may add questions depending upon the Context of examination

1. List the obstacles in chain surveying

2. State different cases with examples for each case
3. What are the examples of case vision free and chaining obstructed?
4. What are the examples of case chaining free and vision obstructed?
5. What are the examples of case both chaining and vision obstructed?

Lab Sheet 2.1.10 CHAIN TRAVERSING

CARRYING OUT CHAIN TRAVERSING TO SURVEY AN AREA BOUNDED BY MORE THAN THREE STAIONS

OBJECTIVE

To carry out chain traversing to survey an area bounded by more than three stations

EQUIPMENT/APPARATUS/RESOURSES

17. Chain
18. Tape
19. Ranging rods
20. Cross staff
21. Arrows
22. Pegs
23. Drawing sheet and drawing instruments

1. TASK ANALYSIS

H. KNOWLEDGE

- Folding, unfolding and spreading of chain
- Reading of chain
- Usage of Tape
- Reading of Tape
- Usage of cross staff
- Measuring length.
- ranging

B.SKILLS

Category of Skill	Sub task
1. Handling of apparatus	• Using chain for measuring length of line on ground • Using tape for measuring length of line on ground • Using cross staff for erecting perpendicular • Driving ranging rods into the ground • Using of drawing instruments
2.Manipulation of apparatus	• Ranging and prolonging a survey line • Measuring length of line on ground using tape and chain • Erecting perpendicular using cross staff • Observing through cross staff and Directing the follower to move accordingly the ranging rod while erecting perpendicular • Following the instruction of surveyor to move accordingly the ranging rod while ranging and erecting perpendicular
3. Precise operation /activity	• Fixing of cross staff accurately on the line with correct view with the help of cross staff head • Directing the follower to move accordingly the ranging rod

	and in fixing it while ranging and erecting perpendicular (duty of surveyor) • following the instruction of surveyor as per his directions while ranging and erecting perpendicular (duty of follower) • Spreading of chain and reading of links of chain correctly • Spreading and reading of tape properly • Measuring the length of line on ground and recording value • Apply correction to chain/tape necessary • Calculatingthe obstructing length • Compare results by plotting.

2. TEACHING POINTS

S. No	Teaching points	Suggestive Duration (min.)
1.	Importance of Traversing	3
2.	Types of Traversing	
3.	Location of the traverse stations.	
4.	Measurement of lengths of Traverse lines with chain and small lengths with tape	15
5.	Plotting the traverse and finding the area	15
5	Precautions	3
	H. Procedural precautions • Care should be taken in selecting the survey stations. • Chain should be handled carefully. • .	
	B. Safety precautions • Care should be taken while carrying the instruments used • Care should be taken while working in Hot Climate	9
	Total	45

3. NEED AND SCOPE OF THE EXPERIMENT

TRAVERSING:

Surveying which involves a series of connected lines is known as 'traversing.' The sides of the traverse are known as 'traverse legs'. In traversing, the lengths of the lines are measured by chain and the directions are fixed by compass or Theodolite or by forming angles with chain and tape.

A traverse may be of two types:

1. Closed traverse.
2. Open traverse.

1. Closed traverse:

When a series of connected lines forms a closed circuit, i.e. when the finishing point coincides with the starting point of a survey, it is called a 'closed traverse'. Closed traverse is suitable for the survey of boundaries of ponds, forests estates, etc.

2. Open traverse:

When a sequence of connected lines extends along a general direction and does not return to the starting point, it is known as 'open traverse' or 'unclosed traverse'. Open traverse is suitable for the survey of roads, rivers, coast lines, etc.

In this experiment, Closed traversing is performed with a Prismatic Compass and Chain in the given area and the lengths of traverse legs are measured with Chain (or Tape for short lengths), the traverse is plotted and area is determined

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	25. Ground and weather conditions. 26. Links of chain and length of each link for correctness. 27. Sagging of Tape if any 28. Loosening of head of cross staff if any. 29. Visibility of numerals on tape
For design of Instruction	Read the teaching points carefully.

5. SCHEME OF EVALUATION

Category of skill	**Sub Task**	**Weight with competency level individually**	**Awarded (50)**

<table>
<tr><td>1. Handling of apparatus</td><td>I. Using chain/ tape for measuring length
J. Using ranging rods for ranging/prolonging a line
K. Using cross staff for erecting perpendicular.</td><td><table><tr><td>A</td><td>3</td></tr><tr><td>B</td><td>3</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Ofapparatus</td><td>G. Measuring length using tape/chain
H. Erecting of perpendicular and Ranging/Prolonging a line
I. Reading values carefully</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>I. Erecting perpendicular
J. Ranging/Prolonging a line
K. Applying appropriate formula to calculate the length of object
L. plotting
M. Compare results in graph by plotting</td><td><table><tr><td>A</td><td>4</td></tr><tr><td>B</td><td>4</td></tr><tr><td>C</td><td>4</td></tr><tr><td>D</td><td>4</td></tr><tr><td>E</td><td>4</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>U. Co-operation
V. Co-ordination
W. Communication
X. Sharing
Y. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

16. ASSESSMENT QUESTIONS(Only suggestive)

7. Establish Traverse Stations in the given area to conduct a closed traverse.
8. Perform traversing in the given area to forming a closed traverse with prismatic compass and chain.
9. Tabulate the lengths using standard format.
10. Plot the closed traverse using the recorded observations and find the area of traverse.

17. VIVA QUESTIONS

(Only suggestive) The teacher may add questions depending upon the Context of examination

1. What do you understand by Traverse?
2. What are the types of Traverses?
3. What is the difference between closed and open Traverse?
4. In what situations a Closed Traverse is run?
5. What are the circumstances in which Open Traverse is run?
6. What are the essential measurements needed to plot a traverse?

LAB SHEET 2.2.1&2 Identifying The Parts And Temporary Adjustments of Prismatic Compass

MEASUREMENT OF THE BEARINGS USING PRISMATIC COMPASS

Set up the prismatic compass to measure the bearing of a survey line

EQUIPMENT/APPARATUS/RESOURSES

1. Prismatic compass
2. Tripod stand
3. Ranging rods
4. Arrows
5. Plumb bob
6. Field book,

1. TASK ANALYSIS

A. KNOWLEDGE

- Mounting of prismatic compass on Tripod stand
- Centering of instrument over the station
- Levelling of the instrument
- Focusing the object
- Reading of angle on Graduated circle
- Recording the bearings in Field book.

B.SKILLS

Category of Skill	Sub task
1. Handling of instrument	• Drawing rough sketch of object points from the station • Identifying the parts of a compass • Unfolding object vane and eye vane • Focusing the prism
2.Manipulation of instrument	• Centering the instrument over the station • Levelling the instrument with Tripod • Sighting the object exactly through eye slit lineup with horse hair
3. Precise operation /activity	• Reading the graduated circle from Magnetic North • Measuring the bearing on Graduated ring • Recording the bearings in field book • Calculating the Reduced bearings from Whole Circle Bearings

LABORATORY SHEET 2.1a

Setting up the compass and observation of

S. No.	Teaching points	Suggestive Duration (Min.)
1.	Description about Prismatic compass A. Importance of Compass B. Types of Compass C. Uses of compass in surveying	5
2.	What is Bearing of a line with respect to Magnetic North	
3.	Bearing of Magnetic North of the compass	
4.	Difference between Whole Circle Bearing and Reduced Bearing	4
5.	Calculating Reduced bearing from W.C.B	6
6.	Plot the bearings measured in Field book	
7.	Precautions	
	A. Procedural precautions • Care should be taken in mounting the instrument. • Reading of Graduated ring exactly • Proper care should be taken in recording the W.C.B and calculating R.B	
	Total	15

3. NEED AND SCOPE OF THE EXPERIMENT

BEARING OF A LINE:

This angular measurement with respect to Magnetic North will be useful to calculate the included angles in a traverse.
The bearing of a line is expressed in degrees and minutes.

PRISMATIC COMPASS

A Prismatic Compass is an instrument used to measure horizontal angle of a survey line with respect to Magnetic North. The ring attached to a magnetic needle is graduated in degrees with its 'N' marked at South. The compass can be rotated freely about its axis so as to take the readings without disturbing the Graduated circle The Reduced Bearings of a survey line can be obtained from this whole circle bearings

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	1. Ball and socket arrangement of Tripod. 2. Visibility through eye vane and object vane. 3. Verticality of horse hair in object vane. 4. Marked readings on Graduated ring
For design of Instruction	Read the teaching points carefully.

5. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of instrument</td><td>A. Drawing rough sketch of object points from the station
B. Identifying the parts of a compass
C. Unfolding object vane and eye vane
D. Focusing the prism</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>3</td></tr><tr><td>C</td><td>2</td></tr><tr><td>D</td><td>3</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation of instrument</td><td>A. Centering the instrument over the station
B. Levelling the instrument with Tripod
C. Sighting the object exactly through eye slit lineup with horse hair</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>A. Reading the graduated circle from Magnetic North
B. Measuring the bearing on Graduated ring
C. Recording the bearings in field book
D. Calculating the Reduced bearings from Whole Circle Bearings</td><td><table><tr><td>A</td><td>5</td></tr><tr><td>B</td><td>5</td></tr><tr><td>C</td><td>5</td></tr><tr><td>D</td><td>5</td></tr><tr><td>Total</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>A. Co-operation
B. Co-ordination
C. Communication
D. Sharing
E. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

6. ASSESSMENT QUESTIONS(Only suggestive)

1. Note down bearings of all the lines at a station.
2. Tabulate observations and draw them in Field book.
3. Calculate the Reduced Bearing.

7. VIVA QUESTIONS

(Only suggestive) The teacher may add questions depending upon the Context of examination

1. What is meant by bearing of a line?
2. State the types of Compass used in surveying?
3. Differentiate between 'Reduced bearing' and 'Whole Circle Bearing'
4. How do you calculate Reducedbearing from W.C.B

CALCULATION OF INCLUDED ANGLE USING COMPASS

OBJECTIVE To perform compass survey to determine included angle by taking bearings of two points from instrument station

EQUIPMENT/APPARATUS/RESOURCES

1. Prismatic compass
2. Ranging rods
3. Arrows
4. Tripod

1. TASK ANALYSIS

A. KNOWLEDGE

- Adjusting or manipulating tripod legs
- Fixing the compass on tripod
- Using plumb bob and checking centering
- Sighting prism vane and object vane
- Leveling the compass
- Observing the readings through prism
- Reading the angles on graduated ring
- Pressing the break pin

B.SKILLS

Category of Skill	Sub task
1. Handling of apparatus	● Bringing the instrument from laboratory to the field ● Unfolding and spreading the tripod ● Adjusting the tripod legs ● Using plum bob for centering ● Fixing the compass on tripod ● Fixing the ranging rod on selected station point ● Folding and unfolding of object vane ● Removing the compass from tripod ,placing it in box after completion of work ● Folding the tripod ● Pressing the break pin
2.Manipulation of apparatus	● Checking whether magnetic needle freely moving showing the direction ● Adjusting the prism ● Leveling compass ● Swinging the compass towards next point ● Adjusting eye vane
3. Precise operation /activity	● Sighting towards object ● Intersecting the object ● Focusing the Prism ● Observing the bearing on graduated ring

	• Computing the included angle

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
1.	Description A. Types of compasses B. Description about Prismatic compass	6
2.	Bearings and types of bearings Whole circle bearing and quadrantal bearing Fore bearing and back bearing	
3.	Setting out compass over station point	
4.	Method of taking bearings for calculating included angle between two survey lines joining at one point	5
5.	Calculating included angle	4
6.	Rough sketch	
7.	Precautions	
	• Care should be taken in operating prism • Care should be taken in focusing eye vane and object vane towards object • Proper care should be taken in recording the reading and calculating the angle • Care should be taken for proper centering and leveling	
	Total	15

3. PLANNING AND ORGANIZATION

Action	Activity
Check for	1. Working condition of compass 2. Oscillation and direction of magnetic needle 3. Functioning of break pin in compass
For design of Instruction	Read the teaching points carefully.

4. SCHEME OF EVALUATION

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	• Bringing the instrument from laboratory to the field • Unfolding and spreading the tripod • Adjusting the tripod legs • Using plum bob for centering • Fixing the compass on tripod • Fixing the ranging rod on selected station point • Folding and unfolding of object vane • Removing the compass from tripod ,placing it in box after completion of work • Folding the tripod • Pressing the break pin	**A 1** **B 1** **C 1** **D 1** **E 1** **F 1** **G 1** **H 1** **I 1** **J 1** **Tot 10**	
2.Manipulation Of apparatus	• Checking whether magnetic needle freely moving showing the direction • Adjusting the prism • Leveling compass • Swinging the compass towards next point and sighting	**A 2** **B 2** **C 3** **D 3** **Tot 10**	
3.Precise Operation/Activity	A. Sighting towards object B. Intersecting the object C. Focusing the Prism D. Observing the bearing on graduated ring E. Computing the included	A 2 B 3 C 3 D 6 E 6	

	angle	Tot 20	
4. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
Total		50	

6. VIVA QUESTIONS

(Only suggestive) The teacher may add questions depending upon the Context of examination

1. Differentiate between whole circle bearing and quadrantal bearing
2. Convert following WCB into QB

(a) $110^0\ 30'$

(b) $192^0\ 00'$

(c) $286^0\ 30'$

(d) $67^0\ 00'$

3.State the use of break pin in compass

4.What is the least count in prismatic compass

5. What should be the difference between FB and BB of a survey line

6. What do you mean by meridian

7.When magnetic needle is free to rotate ,then which direction it shows

8.What are the types of meridians

LAB SHEET 2.2.4 Open traverse with Compass and Chain

PERFORM AN OPEN TRAVERSE WITH COMPASS AND CHAIN.

OBJECTIVE

To perform an open traverse formed by series of connected straight lines with Compass and Chain.

EQUIPMENT/APPARATUS/RESOURSES

7. Prismatic Compass-1 No
8. Tripod -1No
9. Tape (20 m)- 1No
10. Chain (20 m or 30 m) - 1 No.
11. Arrows – 10 Nos
12. Ranging Rods (2m to 3m)-5Nos

1. TASK ANALYSIS

B. KNOWLEDGE

- Adjusting or manipulating tripod legs
- Fixing the compass on tripod
- Using plumb bob and checking centering
- Sighting prism vane and object vane
- Leveling the compass
- Observing the readings through prism
- Reading the bearings on graduated ring
- pressing the break pin

B.SKILLS

Category of Skill	Sub task

1. Handling of apparatus	• Bringing the instrument from laboratory to the fie • Unfolding and spreading the tripod • Adjusting the tripod legs • Using plum bob for centring • Fixing the compass on tripod • Fixing the ranging rod on selected station point • Folding and unfolding of object vane • Removing the compass from tripod ,placing it in box after • completion of work • Folding the tripod • Pressing the break pin
2.Manipulation of apparatus	• Adjusting the mirror, eye vane and sun glass • Checking whether magnetic needle freely moving showing the direction • Focusing the prism to adjusting the height of the prism • Fixing the open traverse on known station points • Setting up the prismatic compass over station and Observing Bearings • Reducing human errors while taking Readings
3. Precise operation /activity	• Sightseeing the object carefully • Reading the bearings and distances carefully • Recording the bearings and distances in the field book • Shifting the instrument to next point and Continuing at all other stations • Tabulating all observations and checking the Local attraction i.e difference of fore bearing and back bearing is $180^0\ 00^1$

LABORATORY SHEET 2.1a

An open traverse with Compass and Chain

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
8.	Description about open Traverse Survey D. Importance of Traverse Survey E. Types of Traverse Survey F. Field Applications of Traverse Survey	6
9.	Bearings and types of bearings Whole Circle Bearing and Quadrantal Bearing Fore bearing and Back bearing	
10.	Setting out compass over station point	
11.	Method of taking bearings for calculating Fore Bearing and Back Bearing at a survey station	5
12.	Calculating Fore Bearing and Back Bearing	4
13.	Rough sketch	
14.	Precautions	
	B. Procedural precautions • Care should be taken in selecting the survey stations. • Chain should be handled carefully. • Compass should be operated gently. **B. Safety precautions** • Care should be taken while carrying the instruments used • Care should be taken while working in Hot Climate	

Total	15

3. NEED AND SCOPE OF THE EXPERIMENT:

TRAVERSING:

Surveying which involves a series of connected lines is known as 'traversing.' The sides of the traverse are known as 'traverse legs'. In traversing, the lengths of the lines are measured by chain and the directions are fixed by compass or Theodolite or by forming angles with chain and tape.

A traverse may be of two types:

1. Closed traverse.
2. Open traverse.

1. Closed traverse:

When a series of connected lines forms a closed circuit, i.e. when the finishing point coincides with the starting point of a survey, it is called a 'closed traverse'. Closed traverse is suitable for the survey of boundaries of ponds, forests estates, etc.

2. Open traverse:

When a sequence of connected lines extends along a general direction and does not return to the starting point, it is known as 'open traverse' or 'unclosed traverse'. Open traverse is suitable for the survey of roads, rivers, coast lines, etc.

In this experiment, closed traversing is performed with a Prismatic Compass and Chain in the given area and the lengths of traverse legs are measured with Chain (or Tape for short lengths), the traverse is plotted and area is determined.

LABORATORY SHEET 2.1a

An open traverse with Compass and Chain

4. PLANNING AND ORGANIZATION

Action	Activity

Check for	5. Working condition of compass 6. . Oscillation and direction of magnetic needle 7. . Functioning of break pin in compass 8. Functioning of sun rays Glass
For design of Instruction	Read the teaching points carefully.

LABOATORY SHEET 2.1a

An open traverse with Compass and Chain

5. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Bringing the instrument from laboratory to the field
B. Unfolding and spreading the Tripod
C. Adjusting the tripod legs
D. Using plum bob for centering
E. Fixing the compass on tripod
F. Fixing the ranging rod on selected station points
G. Folding and unfolding of object vane
H. Removing the compass from tripod ,placing it in box after completion of work
I. Folding the tripod
J. Pressing the break pin</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>1</td></tr><tr><td>C</td><td>2</td></tr><tr><td>D</td><td>2</td></tr><tr><td>E</td><td>1</td></tr><tr><td>F</td><td>2</td></tr><tr><td>G</td><td>1</td></tr><tr><td>H</td><td>2</td></tr><tr><td>I</td><td>1</td></tr><tr><td>J</td><td>1</td></tr><tr><td>Total</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>A. Checking whether magnetic needle freely moving showing the direction
B. Adjusting the prism
C. Leveling compass
D. Swinging the compass towards next point and sighting</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>Tot</td></tr><tr><td>2</td><td>2</td><td>3</td><td>3</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>E. Sighting towards object
F. Intersecting the object
G. Focusing the Prism
H. Observing the bearing on graduated ring
I. Recording the Fore Bearing and Back Bearing</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>3</td></tr><tr><td>C</td><td>3</td></tr><tr><td>D</td><td>6</td></tr><tr><td>E</td><td>9</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>F. Co-operation
G. Co-ordination
H. Communication
I. Sharing
J. Leadership</td><td>5</td><td></td></tr>
</table>

Total	50	

6. ASSESSMENT QUESTIONS:

4. Establish Traverse Stations in the given line to conduct a open traverse.
5. Perform traversing in the given line to forming a open traverse with prismatic compass and chain.
6. Tabulate the lengths and bearings of the traverse lines using standard format.
7. Plot the open traverse using the recorded observations and find the fore bearing and back bearing of traverse.

7. VIVA QUESTIONS:

(Only suggestive) The teacher may add questions depending upon the Context of examination

1. What is the purpose of prismatic compass in surveying?
2. Differentiate between whole circle bearing and quadrantal bearing
3. Convert following WCB into QB

(a) $110^0\ 30^1$

(b) $192^0\ 00^1$

4. .State the use of break pin in compass
5. For what a mirror is provided to the object vane?
6. What should be the difference between FB and BB of a survey line
7. What do you mean by meridian
8. When magnetic needle is free to rotate ,then which direction it shows
9. What is meant by traverse? Explain the check applied to a closed traverse
10. Define local attraction. How do you detect it?

11 What is the least reading that can be read from a compass?

12 Where is the 180º marked on the graduated ring?

Closed traversewith Prismatic Compass and Chain

OBJECTIVE:

To perform a closed traverse survey toplot the plan of the area and to find the area using compass and chain and

EQUIPMENT/APPARATUS/RESOURCES:

1. Chain (20 m or 30 m) – 1 No.
2. Tape (20 m) – 1 No.
3. Prismatic Compass – 1 No.
4. Tripod – 1 No.
5. Ranging Rods (2 or 3 m) – 5 Nos.
6. Arrows – 10 Nos.

1. TASK ANALYSIS

A.KNOWLEDGE:

- Procedure for measurement of a line with Chain and small lengths with Tape
- System of whole circle bearings
- Measurement of the bearings of a line with Prismatic compass.
- Recording Fore and Back bearings of lines.
- Calculating the included angles using measured bearings.
- Checking the measured bearings and angles
- Plotting the traverse with measurements

B.SKILLS:

Category of Skill	Sub task
1. Handling of Apparatus	• Use of Ranging rods or arrows for establishing the Traverse Stations. • Folding and unfolding of Chain and fully extending it for measuring lengths • Using arrows at the end of chain for continuation of chain line • Using the tape for Measuring small lengths. • Setting up Prismatic compass over stations and performing temporary adjustments
2. Manipulation of Apparatus	• Giving identification marks to stations. • Attaching Flags to ranging rods Flips or Tags to arrows • Stretching the chain straight and extending fully • Checking for any kinks or bent in links • Fixing the Ranging rods firmly and vertically • Setting the compass and adjusting perfectly
3. Precise operation /activity	• Using Ranging rods for ranging the line if length exceeds that of chain length. • Measuring the lengths correctly with chain • Observing the bearings with prismatic compass • Calculating the included angles and checking them • Plotting the traverse and finding the area

2.TEACHING POINTS:

S. No	Teaching points	Suggestive Duration (min.)
1.	Purpose of Traversing	3
2.	Types of Traversing	
3.	Location of the traverse stations.	
4.	Measurement of lengths of Traverse lines with chain and small lengths with tape	3
5.	Setting up of Compass at Traverse stations	
6.	Temporary adjustments of Compass.	
7.	Finding Fore and back bearing from each survey station	6
8.	Calculation of included angles	
9.	Checking the included angles	
10.	Plotting the traverse and finding the area	
11.	Precautions	3
	C. Procedural precautions • Care should be taken in selecting the survey stations. • Chain should be handled carefully. • Compass should be operated gently.	
	B. Safety precautions • Care should be taken while carrying the instruments used • Care should be taken while working in Hot Climate	
	Total	15

3.NEED AND SCOPE OF THE EXPERIMENT:

TRAVERSING:

Surveying which involves a series of connected lines is known as 'traversing.' The sides of the traverse are known as 'traverse legs'. In traversing, the lengths of the lines are measured by chain and the directions are fixed by compass or Theodolite or by forming angles with chain and tape.

A traverse may be of two types:

3. Closedtraverse.

4. Opentraverse.

3. Closed traverse:

When a series of connected lines forms a closed circuit, i.e. when the finishing point coincides with the starting point of a survey, it is called a 'closed traverse'. Closed traverse is suitable for the survey of boundaries of ponds, forests estates, etc.

4. Open traverse:

When a sequence of connected lines extends along a general direction and does not return to the starting point, it is known as 'open traverse' or 'unclosed traverse'. Open traverse is suitable for the survey of roads, rivers, coast lines, etc.

In this experiment, Closed traversing is performed with a Prismatic Compass and Chain in the given area and the lengths of traverse legs are measured with Chain (or Tape for short lengths), the traverse is plotted and area is determined.

4. PLANNING AND ORGANIZATION:

Action	Activity
	9. Field conditions. 10. Physical condition of Chain and damages if any. 11. Working conditions of Prismatic Compass. 12. Presence of objects causing Magnetic attraction

5. SCHEME OF EVALUATION:

Category of skill	Check for Sub Task	Weightage with competency level individually	Awarded (50)
1. Handling of apparatus	For design of Instruction. Read the teaching points carefully. A. Use of Ranging rods or arrows for establishing the Traverse Stations. B. Folding and unfolding of Chain and fully extending it for measuring lengths C. Using arrows at the end of chain for continuation of chain line D. Using the tape for Measuring small lengths. E. Setting up Prismatic compass over stations and performing temporary adjustments	A 2 B 2 C 1 D 2 E 3 Total 10	

<table>
<tr>
<td>2.Manipulation ofapparatus</td>
<td>A. Giving identification marks to stations.
B. Attaching Flags to ranging rods Flips or Tags to arrows.
C. Stretching the chain straight and extending fully.
D. Checking for any kinks or bent in links.
E. Fixing the Ranging rods firmly and vertically.
F. Setting the compass and adjusting perfectly.</td>
<td><table>
<tr><td>A</td><td>1</td></tr>
<tr><td>B</td><td>1</td></tr>
<tr><td>C</td><td>3</td></tr>
<tr><td>D</td><td>1</td></tr>
<tr><td>E</td><td>3</td></tr>
<tr><td>F</td><td>3</td></tr>
<tr><td>Total</td><td>12</td></tr>
</table></td>
<td></td>
</tr>
<tr>
<td>3.Precise Operation/Activity</td>
<td>A. Using Ranging rods for ranging the line if length exceeds that of chain length.
B. Measuring the lengths correctly with chain
C. Observing the bearings with prismatic compass
D. Calculating the included angles and checking them
E. Plotting the traverse and finding the area</td>
<td><table>
<tr><td>A</td><td>4</td></tr>
<tr><td>B</td><td>2</td></tr>
<tr><td>C</td><td>6</td></tr>
<tr><td>D</td><td>5</td></tr>
<tr><td>E</td><td>6</td></tr>
<tr><td>Total</td><td>23</td></tr>
</table></td>
<td></td>
</tr>
<tr>
<td>4. Values</td>
<td>K. Co-operation.
L. Co-ordination.
M. Communication.
N. Sharing.
O. Leadership.</td>
<td><table>
<tr><td></td></tr>
<tr><td>5</td></tr>
</table></td>
<td></td>
</tr>
<tr>
<td colspan="2">Total</td>
<td>50</td>
<td></td>
</tr>
</table>

6. ASSESSMENT QUESTIONS:

8. Establish Traverse Stations in the given area to conduct a closed traverse.
9. Perform traversing in the given area to forming a closed traverse with prismatic compass and chain.
10. Tabulate the lengths and bearings of the traverse lines using standard format.
11. Plot the closed traverse using the recorded observations and find the area of traverse.

7. VIVA QUESTIONS:

(Only suggestive. The teacher may add questions depending upon the Context of examination)

1. When do you need a Traverse survey?
2. What are the limitations in Traverse survey?
3. What is the difference between closed and open Traverse?
4. In what situations a Closed Traverse is run?
5. What are the circumstances in which Open Traverse is run?
6. What are the essential measurements needed to plot a traverse?
7. What are the checks for a closed traverse?
8. How do you detect the error in a closed traverse?
9. What is the permissible error of closure?
10. What method do you use to adjust the error in closed traverse?

Plotting the closed traverse from field data and adjusting for closing error by Bowditch rule.

OBJECTIVE:

To apply Bowditch rulefor correcting closing error while plotting aclosed area from field data.

EQUIPMENT/APPARATUS/RESOURCES:

8. Drawing table.
9. Drawing sheet.
10. Clips or pins
11. Scale.
12. Pencil.
13. Eraser.
14. Protractor.
15. Mini drafter.

1. TASK ANALYSIS:

A.KNOWLEDGE:

- Traversing by compass.
- Plotting of closed traverse

- Using drawing tools.
- Drawing Engineering Geometrical figures.
- Closing error and its adjustment using Bowditch's graphical method

B.SKILLS:

Category of Skill	Sub task
1. Handling of Apparatus	• Fixing a drawing sheet to drawing board • Fixing a Mini drafter to drawing board • Keeping smooth side of drawing sheet up
2. Manipulation of Apparatus	• Using the drawing tools correctly to plot. • Drawing the lines sharply with uniform stroke with pencil • Keeping the sheet clean without strains • Adopting a suitable scale
3. Precise operation /activity	• Marking the lengths and angles correctly with appropriate drawing tools • Plotting the traverse neatly • Measuring closing error • Adjusting closing error using Bowditch's graphical method • Replotting with error adjusted.

2.TEACHING POINTS:

S. No	Teaching points	Suggestive Duration (min.)
1.	Concept of Compass traversing	3
2.	Importance of plotting the traverse	
3.	Tools required for plotting.	
4.	Adoption of suitable scale	3
5.	Usage of drawing tools	
6.	Plotting the field data	
7.	Checking the for closing error	6
8.	Adjustment of closing error using Bowditch's method	
9.	Precautions	3
	D. Procedural precautions • Care should be taken in handling the drawing tools • Drawing sheet should be handled neatly.	
	B. Safety precautions • Care should be taken while using sharp drawing tools like compass	

Total	15

3.NEED AND SCOPE OF THE EXPERIMENT:

Closed traversing is performed with a Prismatic Compass and Chain in the given area and the lengths of traverse legs are measured with Chain (or Tape for short lengths), and the bearings of the lines are measured with Prismatic compass.

Using the recorded field data, the closed traverse is plotted and closing error is measured. The error is adjusted using Bowditch's graphical method.

4. PLANNING AND ORGANIZATION:

Action	Activity
Check for	13. Field data and calculations. 14. Physical condition of drawing board. 15. Working condition of drawing tools. 16. Accuracy of drawing and closing error
For design of Instruction	Read the teaching points carefully.

5. SCHEME OF EVALUATION:

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	A. Fixing a drawing sheet to drawing board B. Fixing a Mini drafter to drawing board C. Keeping smooth side of drawing sheet up	A 3 B 4 C 3 Total 10	

2.Manipulation of apparatus	A. Using the drawing tools correctly to plot. B. Drawing the lines sharply with uniform stroke with pencil C. Keeping the sheet clean without strains D. Adopting a suitable scale	A 3 B 3 C 2 D 4 Tota 12	
3.Precise Operation/Activity	A. Marking the lengths and angles correctly with appropriate drawing tools B. Plotting the traverse neatly C. Measuring closing error D. Adjusting closing error using Bowditch's graphical method E. Replotting with error adjusted	A 5 B 4 C 5 D 4 E 5 Total 23	
4. Values	P. Co-operation Q. Co-ordination R. Communication S. Sharing T. Leadership	5	
Total		50	

8. ASSESSMENT QUESTIONS:(Only suggestive)

12. Plot the closed traversing with the given field observations
13. Find the closing error of the plotted traverse.
14. Adjust the closing error in the plotted traverse using Bowditch's graphical method.

9. VIVA QUESTIONS:

(Only suggestive. The teacher may add questions depending upon the Context of examination)

11. What is a closed Traverse?

12. What are the observations taken during the performance of a closed traverse?

13. What is the data to be computed for plotting a closed traverse?

14. What is a closing error?

15. Why does the error occur?

16. How do you minimize or avoid the error?
17. How do you detect the error in a closed traverse?
18. What is the method used to adjust closing error?

LAB SHEET 2.2.7 METHOD OF RADIATION WITH PRISMATIC COMPASS AND CHAIN

METHOD OF RADIATION WITH PRISMATIC COMPASS AND CHAIN

OBJECTIVE:

To determine the area bounded by the given points by the method of radiation with prismatic compass and chain.

1. Equipment/Apparatus/Resources:

a. prismatic compass-1
b. tripod stand-1
c. ranging rods-5
d. tape-1
e. metric chain(20m or 30m)-1
f. arrows-10
g. plumb bob-1

2. TASK ANALYSIS:

- **A. Knowledge**:
    - Procedure for measurement of a line with Chain and small lengths with Tape
    - System of whole circle bearings
    - Measurement of the bearings of a line with Prismatic compass.
    - Calculating the included angles using measured bearings.
    - Checking the measured bearings and angles
    - Calculating triangle area
    - Plotting the area bounded by given points with measurements

B.Skill

Category of Skill	Sub task
1. Handling of Apparatus	• Use of Ranging rods or arrows for establishing the Traverse Stations. • Folding and unfolding of Chain and fully extending it for measuring lengths • Using arrows at the end of chain for continuation of chain line • Using the tape for Measuring small lengths. • Setting up Prismatic compass over stations and performing temporary adjustments
2. Manipulation of Apparatus	• Giving identification marks to stations. • Attaching Flags to ranging rods Flips or Tags to arrows • Stretching the chain straight and extending fully • Checking for any kinks or bent in links • Fixing the Ranging rods firmly and vertically • Setting the compass and adjusting perfectly
3. Precise operation /activity	• Using Ranging rods for ranging the line if length exceeds that of chain length. • Measuring the lengths of radial lines correctly with chain • Observing the bearings with prismatic compass • Calculating the included angles and checking them • Calculating the area • Plotting the area bounded by given points with measurements

3. TEACHING POINTS:

S.No	Teaching points	Suggestive duration (min)
1.	Purpose of Method of radiation	
2.	Measurement of lengths of Radial lines with chain and small lengths with	3

	tape	
3.	Setting up of Compass and temporary adjustments of Compass.	
4.	Finding bearings of radial lines	
5.	Calculation of included angles	5
6.	Checking the included angles	
7.	Calculation of component triangle area & total area	
8.	Plotting the area bounded by given points	5
9.	Precautions	
10.	**E. Procedural precautions** • Care should be taken in selecting the survey stations. • Chain should be handled carefully. • Compass should be operated gently.	2
	B. Safety precautions • Care should be taken while carrying the instruments used • Care should be taken while working in Hot Climate	
	Total	15

4. NEED AND SCOPE OF THE EXPERIMENT:

Prismatic compass is used to take bearings of the given points thereby calculating included angles.

Method of radiation useful for calculation of area bounded by given points in the field by using included angles.

Prismatic compass is useful for surveying when

1) Given area is undulated

2) Given area is dense forest

3) Given area is long and narrow eg. Roads and railway lines

5. PLANNING AND ORGANISATION:

ACTION	ACTIVITY
Check for	17. Field conditions. 18. Physical condition of Chain and damages if any. 19. Working conditions of Prismatic Compass. 20. Presence of objects causing local attraction
For design of Instruction.	Read the teaching points carefully.

5. SCHEME OF EVALUATION:

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>F. Use of Ranging rods or arrows for establishing the given stations.
G. Folding and unfolding of Chain and fully extending it for measuring lengths
H. Using arrows at the end of chain for continuation of chain line
I. Using the tape for Measuring small lengths.
J. Setting up Prismatic compass and performing temporary adjustments</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>2</td></tr><tr><td>C</td><td>1</td></tr><tr><td>D</td><td>2</td></tr><tr><td>E</td><td>3</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>A.
2.Manipulation ofapparatus</td><td>G. Giving identification marks to stations.
H. Attaching Flags to ranging rods Flips or Tags to arrows.
I. Stretching the chain straight and extending fully.
J. Checking for any kinks or bent in links.
K. Fixing the Ranging rods firmly and vertically.
L. Setting the compass and adjusting perfectly.</td><td><table><tr><td>A</td><td>1</td></tr><tr><td>B</td><td>1</td></tr><tr><td>C</td><td>2</td></tr><tr><td>D</td><td>1</td></tr><tr><td>E</td><td>2</td></tr><tr><td>F</td><td>3</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>A. Using Ranging rods for ranging the line if length exceeds that of chain length.
B. Measuring the lengths correctly with chain
C. Observing the bearings with prismatic compass
D. Calculating the included angles and checking them
E. Calculation of component triangle area & total area
F. Plotting the area bounded by given points</td><td><table><tr><td>A</td><td>3</td></tr><tr><td>B</td><td>2</td></tr><tr><td>C</td><td>5</td></tr><tr><td>D</td><td>5</td></tr><tr><td>E</td><td>5</td></tr><tr><td>F</td><td>5</td></tr><tr><td>Total</td><td>25</td></tr></table></td><td></td></tr>
</table>

4. Values	U. Co-operation. V. Co-ordination. W. Communication. X. Sharing. Y. Leadership.	5	
Total		50	

6. ASSESSMENT QUESTIONS: (Suggestive)

a. Note down the length of radial lines.
b. Calculate included angles between radial lines and tabulate observations.
c. Determine area of component triangles
d. Determine total area bounded by given points
e. Plot the area bounded by given points

7. QUESTIONS FOR VIVA VOCE : (Suggestive)

a. What is the principle used in compass surveying?
b. What is the purpose of compass surveying?
c. State situations which are favourable for conducting compass survey
d. Distinguish between magnetic meridian and true meridian
e. How to calculate back bearing from fore bearing of a line?
f. What are the differences between whole circle system and Quadrantal system of bearings?
g. What are the functions of a) break pin b) lifting pin
h. What are the essential measurements needed to plot the area bounded by given points?
i. What is the check for included angles of method of radiation?

Determine the distance between two accessible points from a single station

OBJECTIVE

To determine the distance between two accessible points from a single station

EQUIPMENTS/APPARATUS/RESOURCES

1. Tripod Stand -1No
2. Prismatic Compass -1No
3. Ranging rods- 2No
4. Tape -1No
5. Plumb bob -1No

1. TASK ANALYSIS

A. KNOWLEDGE

a. Procedure for measurement of a line with Tape

b. System of whole circle bearings

c. Measurement of the bearings of a line with Prismatic compass.

d. Plotting the points with measurements.

B. SKILLS

S.No	Category	Classified Skills
1	Handling of apparatus/tools/material	1. Centering the tripod stand. 2. Leveling the compass and performing temporary adjustments 3. Focusing the prism.
2	Manipulation of tools/equipment	1. Sighting the ranging rod and observing the bearing of the line. 2. Measurement of distance

		between ranging rod and instrument by using tape.
3	Precise operations	1. Calculation of angle θ. 2. Calculations of length AB.

2. TEACHING POINTS

S.No	Teaching Points	Suggestive Duration (min)
1	Description of compass	2
2	Centering of tripod stand	3
3	Leveling of compass	
4	Focusing of the prism to read the graduations clearly	2
5	Sighting the objects and reading the observations	2
6	Calculation of the length AB	3
7	Precautions	3
	A. Procedural precautions: Compass should be operated carefully. B. Safety precaution: 1. Care should be taken while carrying the instruments. 2. Care should be taken while working in hot climate.	
	Total	15

3. NEED AND SCOPE OF THE EXPERIMENT

PRISMATIC COMPASS

Prismatic compass is an instrument based on the principle that a freely suspended or pivoted magnetic needle point in the direction of magnetic meridian. The bearings of lines are obtained in the WCB system.

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	1. Any local attractions which effect the readings 2. Set up and level the compass properly 3. Always look along the needle and not across it thus avoiding parallax.
For Design of Instruction	Read the teaching points carefully

5. SCHEME OF EVAUATION

Category of Skill	Sub Task	Weight with comptency level individually	Awarded (50)
1. Handling of apparatus	A. Centering the tripod stand B. Leveling the compass C. Focusing the prism	A: 5, B: 5, C: 5, TOT: 15	
2. Manipulation of apparatus	A. Sighting the ranging rod and observing the bearing of the line. B. Measurement of distance between ranging rod and instrument using tape	A: 10, B: 10, TOT: 20	
3. Precise Operation/ Activity	A. Calculation of angle θ. B. Calculation of length AB	A: 5, B: 5, TOT: 10	
4. Values	1.Co-operatio 2. Co-ordination 3. Communication 4.Sharing	5	

	5. Leadership		
Total		50	

6. VIVA QUESTIONS:

(Only suggestive the teacher may add questions depending upon the context of examination)

1. Define true meridian and bearing?
2. Differentiate between Prismatic compass and Surveyor's compass?
3. What do you understand by Whole circle bearing and quadrantal bearing of a line?
4. What is local attraction? What are the sources of local attractions?

THE HORIZONTAL DISTANCE BETWEEN TWO INACCESSIBLE POINTS – COMPASS SURVEY

OBJECTIVE

To determine the distance between two inaccessible points using compass and other accessories.

EQUIPMENT/APPARATUS/RESOURCES

1. Compass with tripod stand
2. **Tape/Chain**
3. Ranging rods
4. **Arrows**
5. Pegs
6. **Plumb bob**

1.TASK ANALYSIS

A. KNOWLEDGE

- Principle, importance of compass survey
- Applications of compass survey
- Identifying parts of compass and their function

B. SKILLS

S.No	Category of skill	Sub task
1	Handling the apparatus	• Boxing and unboxing of compass • Clamping the compass securely to the tripod stand. • Folding and unfolding of chain/tape.
2	Manipulation of apparatus	• Centering the compass (by using plumb bob or a small stone) • Levelling the instrument with the help of ball and socket arrangement. • Adjustment of prism till the readings on the graduated ring appear clear and sharp.

3	Precise operation/ activity	• Conducting Reconnaissance 1) To set the station such that intervisibility of points/stations is achieved. 2) to confirm the stations are free from magnetic substances • Preparation of index sketch • Marking station on the ground • Bisecting the ranging rod at the required point through the object vane. (after centering and levelling) • Measurement of bearings.

2. TEACHING POINTS

S.No	Teaching points	Suggestive duration (min)
1	Need for compass survey	10
2	Principle of compass	
3	Description of component parts of compass and their function	
4	Handling the apparatus	5
5	Manipulation of apparatus	
6	Demonstration of exercise	10
7	Applications of compass survey	
8	Necessity for repeating the test	
9	Precautions 1) check whether the magnetic needle is perfectly straight. 2) check the Pivot for any bent. 3) check whether the needle for Sluggishness. 4) check the pivot point for Bluntness. 5) check for the magnetic substances in the field as well as the personal involved in the task. 6) Plane of sight to be vertical	

3. NEED AND SCOPE OF THE EXERCISE

1. When the distance between inaccessible points cannot be obtained by chain survey dueto undulations or on narrow spaces, compass survey plays a major role.

2. We can obtain horizontal distances as well as horizontal angles.

4. PLANNING AND ORGANIZATION

S.No.	Action	Activity
1	Check for	1. Accuracy of compass 2. Condition of compass 3. Availability of all apparatus
2	For design of instruction	Read the teaching points carefully

5. SCHEME OF EVALUATION

S.No.	Category of skill	Sub task	Weigt with competency level individually	Awarded
1	Handling the apparatus	A. Boxing and unboxing of compass B. Clamping the compass securely to the tripod stand. C. Folding and unfolding of chain/tape.	A 2 B 2 C 1 Total 5	
2	Manipulation of apparatus	A. Centering the compass (by using plumb bob or a small stone) B. Levelling the instrument with the help of ball and socket arrangement. C. Adjustment of prism till the readings on the graduated ring appear clear and sharp.	A 5 B 5 C 2 Total 12	
3	Precise operation/ activity	A. Conducting Reconnaissance 1) To set the station such that intervisibility of points/stations is achieved. 2) to confirm the stations are free from magnetic substances B. Preparation of index sketch C. Marking station on the ground D. Bisecting the ranging rod at the required point through the object vane. (after centering and levelling) E. Measurement of bearings.	A 4 B 3 C 3 D 2 E 6 Total 18	
4	Values	A. Cooperation B. Co-ordination C. Communication D. Sharing E. Leadership	A 1 B 1 C 1 D 1 E 1 Total 5	
Total			40	

6. ASSESMENT QUESTIONS (ONLY SUGGESTIVE)

1. What is the principle on which the compass works? (instrument)
2. What is the principle compass survey? (survey work)
3. If magnetic needle is not straight, what is its effect on the results?
4. What are the limits to perform compass surveying?

7. VIVA QUESTIONS

(only suggestive. The teacher may add questions depending upon the context ofexamination)

1. What is the importance of the compass survey?

2. How to convert W.C.B TO R.B and vice-versa?

3. What type of compass is used for the survey today?

4. What precautions do you take in performing the survey?

LAB SHEET 2.3.2 To perform the temporary adjustments of Dumpy level

TASK ANALYSIS

OBJECTIVE:To perform the temporary adjustments of Dumpy level.

A) Knowledge :

Dumpy level, functions of Dumpy level, Tripod, steps involved in Temporary adjustments of Dumpy level, Plumb bob, Pegs, Levelling staff.

Terminology: Benchmark, Foresight, Back sight.

B) Skill :

Category of skill	Sub Task
1) Handling of Apparatus	• Fixing the Tripod • Setting up dumpy level on Tripod • Approximating the levelling by Tripod legs • Holding the levelling staff
2) Manipulation of Apparatus	• Focussing the eye piece • Focussing the object glass • Making the bubble tube centre by adjusting foot screws for accurate levelling
3) Precise Operation	• Accurate levelling • Taking the back sight , intermediate sight, fore sight by observing the readings on levelling staff over the telescope • Observations and tabulations.
4) Values	• Cooperation • Coordination • Communication • Sharing • Leadership

Teaching Points

S.no:	Teaching point	Time (min)
1	Functions of Dumpy Level	1
2	Steps involved in temporary adjustments a) Setting up the instrument b) Levelling up the instrument by adjusting Tripod leg and bubble tube c) Focussing the eye piece d) Focussing the object	 2 3 3 2
3	Handling the Instrument to take reading by using levelling staff	1
4	Take the B.S,I.S,F.S observed through telescope on levelling staff	1
5	Precautions to be taken in levelling	1
6	The readings are tabulated in notebook	1

LAB SHEET 2.3.3 Differential Levelling Using Dumpy Level

DETERMINATION OF DIFFERENCE IN ELEVATION BETWEEN TWO STATIONS USING DIFFERENTIAL LEVELLING

OBJECTIVE

To perform significant steps to calculate the difference in elevation between two stations using differential leveling

EQUIPMENT/APPARATUS/RESOURSES

1. Dumpy Level 01 no.,
2. Level Staff 01 no.,
3. Pegs 02 nos.,
4. Plumb Bob 01 no.,
5. Tripod stand 01 no.,

1. TASK ANALYSIS

A. KNOWLEDGE

- *Lifting the Dumpy Level from Box / case*,
- *Fixing the Dumpy Level to Tripod*,
- *Fixing the Tripod on ground*,
- *Holding the Level Staff*,
- *Leveling the instrument*
- *Focusing the Objective Lens*,
- *Focusing the Eye-piece*,
- *Observing the reading from level staff through Dumpy Level*,
- *Noting the (observed) reading (from the level staff) in work sheet*,

B. SKILLS

Category of Skill	Sub task
1. Handling of apparatus	• Fixing the Tripod on ground. • Lifting the Dumpy Level from Box / case. • Fixing the Dumpy Level to Tripod. • Holding the Level Staff.

2.Manipulation of apparatus	• Centering the bubble • Observing the reading from level staff through Dumpy Level.
3. Precise operation /activity	• Focusing the Objective Lens. • Focusing the Eye-piece. • Leveling the instrument • Noting the (observed) reading (from the level staff) in work sheet

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
1.	Description about Dumpy Level A. Importance of Dumpy Level	1
	B. Parts Dumpy	2
	C. Applications of Dumpy Level	1
2.	What is Differential Levelling?	2
3.	Formula description	2
4.	Calculating Difference in Elevation	3
5.	Precautions	4
	A. Procedural precautions • Care should be taken in operating the objective and eye piece of Dumpy Level. • Properly hold the level staff as instructed. • Proper care should be taken in noting the staff reading. • Always align the bubble to the centre of run in the bubble tube before observing and noting the reading from level staff.	

Total	15

3. NEED AND SCOPE OF THE EXPERIMENT

Differential Levelling :

The differential leveling is performed when the distance between two points is more. In this process, number of inter stations are located and instrument is shifted to each station and observed the elevation of inter station points. Finally difference between original two points is determined.

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	1. Working condition of Dumpy Level. 2. Tripod Legs 3. Level Staff in both unfolded and folded conditions.
For design of Instruction	Read the teaching points carefully.

5. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Fixing the Tripod on ground.
B. Lifting the Dumpy Level from Box / case.
C. Fixing the Dumpy Level to Tripod
D. Holding the Level Staff</td><td><table><tr><td>A</td><td>1</td></tr><tr><td>B</td><td>2</td></tr><tr><td>C</td><td>4</td></tr><tr><td>D</td><td>3</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>A. Centering the bubble
B. Observing the reading from level staff through Dumpy Level</td><td><table><tr><td>A</td><td>B</td><td>Tot</td></tr><tr><td>8</td><td>7</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation / Activity</td><td>A. Focusing the Objective Lens
B. Focusing the Eye-piece
C. Leveling the instrument
D. Noting the (observed) reading (from the level staff) in work sheet</td><td><table><tr><td>A</td><td>5</td></tr><tr><td>B</td><td>5</td></tr><tr><td>C</td><td>5</td></tr><tr><td>D</td><td>5</td></tr><tr><td>Total</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>A. Co-operation
B. Co-ordination
C. Communication
D. Sharing
E. Leadership</td><td><table><tr><td>A</td><td>1</td></tr><tr><td>B</td><td>1</td></tr><tr><td>C</td><td>1</td></tr><tr><td>D</td><td>1</td></tr><tr><td>E</td><td>1</td></tr><tr><td>Total</td><td>5</td></tr></table></td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

6. ASSESSMENT QUESTIONS (suggestive only)

(this is for Formative Assessment only)

1. What is differential levelling?
2. What is Line of Collimation?
3. What is Reduced Level?
4. What is Bench Mark?
5. What is an adjustment in leveling instrument?
6. What is the Height of Instrument?
7. How to take staff readings?

7. VIVA QUESTIONS (suggestive only)

(this is for Summative Assessment)

The teacher may add questions depending upon the Context of examination

1. What is the Principle of Leveling?
2. What are the Principles of Surveying?
3. Define Surveying.
4. What is focusing of objective?
5. What is focusing of eye piece?
6. What is Leveling of instrument?

LAB SHEET 2.3.4 Reciprocal Levelling

True Difference in Elevation Between Two far off Station by Using Reciprocal Levelling

OBJECTIVE

To perform a task to find the True difference in elevation between two far off station points by Reciprocal Levelling.

EQUIPMENT

1. Dumpy level with tripod stand
2. Plumb bob
3. Levelling staff
4. Pegs

1. TASK ANALYSIS

A. KNOWLEDGE

- Definition of Reciprocal levelling
- Knowledge on Back sight, Bench Mark
- Temporary adjustment of instrument
- To take reading on the Levelling staff
- Knowledge on Curvature , Refraction
- Difference between Level line, collimation line and Horizontal line

B. Skills

S.No	Category	Classified Skills
1	Handling of apparatus/tools/material	A. Setting Dumpy level on tripod stand
2		B .Centering the instrument by using the Plumb bob
3		C .Levelling the instrument using foot screws
4		D. Elimination of parallax by focusing eye piece and objective
5		
6	Manipulation of tools/equipment	A. Bisecting the Staff using telescope
7		B. Observing staff readings by focussing the telescope
8		C. Noting the staff readings
9		
10		
11	Precise operations	Calculation of True elevation difference
12		Calculation R.L of station B
13		

14		
15		

2. TEACHING POINTS

S. No	Teaching points	Suggestive Duration (min.)
1.	Need of Reciprocal levelling	5
2.	True level difference between two far off stations.	8
3	Precautions : 1. Temporary adjustments of instrument should not be disturbed	2
	Total	15

3. NEED AND SCOPE OF THE EXPERIMENT

Reciprocal Levelling.

This method is adopted when it is not possible to set up the Level mid way between the points (When levelling is performed across a river or valley).

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	1.Working condition of Dumpy Level and Levelling staff

5. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded
(50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Setting Dumpy level on tripod stand
B. Centering the instrument by using the Plumb bob.
C .Levelling the instrument using foot screws
D. Elimination of parallax by focusing eye piece and objective</td><td><table><tr><th>A</th><th>B</th><th>C</th><th>D</th><th>Total</th></tr><tr><td>1</td><td>3</td><td>3</td><td>3</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation of apparatus</td><td>A. Bisecting the Staff using telescope
B. Observing staff readings by focussing the telescope
C. Noting the staff readings</td><td><table><tr><th>A</th><th>B</th><th>C</th><th>Tot</th></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>A. Calculation of True elevation difference
B. Calculation of R.L of B</td><td>A= 15 m
B= 5 m</td><td></td></tr>
</table>

4. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	Each carries one mark Total = 5 m	
Total		50	

6. ASSESSMENT QUESTIONS(Only suggestive)

1. Tabulate observations made for the experiment.
2. Find the true level difference

7. VIVA QUESTIONS

1. What is the Reciprocal Levelling?
2. What is a Level Surface?.
3. What is focusing of objective?
4. What is focusing of eye piece?
5. What is Levelling of instrument?

LAB SHEET 2.3.5 Collimation Error Of A Dumpy Level

DETERMINATION OF COLLIMATION ERROR OF A DUMPY LEVEL BY CONDUCTING RECIPORCAL LEVELLING

OBJECTIVE

To determine the COLLIMATION ERROR OF A DUMPY LEVEL BY CONDUCTING RECIPORCAL LEVELLING.

EQUIPMENT/APPARATUS/RESOURSES

6. Dumpy Level 01 no.,
7. Level Staff 01 no.,
8. Pegs 02 nos.,
9. Plumb Bob 01 no.,
10. Tripod stand 01 no.,

2. TASK ANALYSIS

C. KNOWLEDGE

- *Lifting the Dumpy Level from Box / case*,
- *Fixing the Dumpy Level to Tripod*,
- *Fixing the Tripod on ground*,
- *Holding the Level Staff*,
- *Leveling the instrument*
- *Focusing the Objective Lens*,
- *Focusing the Eye-piece*,
- *Observing the reading from level staff through Dumpy Level*,
- *Noting the (observed) reading (from the level staff) in work sheet*,
- *Measuring the distance between given (two) points*,
- *Calculating the collimation error*,

D. SKILLS

Category of Skill	Sub task
1. Handling of apparatus	• Fixing the Tripod on ground. • Lifting the Dumpy Level from Box / case. • Fixing the Dumpy Level to Tripod. • Holding the Level Staff.
2.Manipulation of apparatus	• Observing the reading from level staff through Dumpy Level. • Measuring the distance between given (two) points.

3. Precise operation /activity	• Focusing the Objective Lens. • Focusing the Eye-piece. • Leveling the instrument • Calculating the collimation error. • Noting the (observed) reading (from the level staff) in work sheet

LABORATORY SHEET 3.5

Collimation error of Dumpy Level by conducting Reciprocal Leveling

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
6.	Description about Dumpy Level D. Importance of Dumpy Level	1
	E. Parts Dumpy	2
	F. Applications of Dumpy Level	1
7.	What is Reciprocal Leveling?	1
8.	What is Collimation Error?	1
9.	Collimation Error, formula description	3
10.	Calculating actual collimation error, el	2
11.	Precautions	4
	B. Procedural precautions • Care should be taken in operating the objective and eye piece of Dumpy Level. • Properly hold the level staff as instructed. • Proper care should be taken in noting the staff reading and calculating the collimation error. • Properly measure the distance between the given two points without kinks, bends, etc. • Always align the bubble to the centre of run in the bubble tube before observing and noting the reading from level staff.	

Total	15

LABORATORY SHEET 3.5

Collimation error of Dumpy Level by conducting Reciprocal Leveling

3. NEED AND SCOPE OF THE EXPERIMENT

COLLIMATION ERROR:

The total error is combination of error of collimation, error due to curvature and error due to refraction. i.e., $e = e_l + e_c - e_r$.

Level Collimation is the process of determining the error present in an instrument. Once the error is determined, the instrument can be adjusted or the error can be mathematically applied to each reading made with the instrument. The drawback to mathematical error resolution is that the sight length of each reading is necessary since the error is a function of distance.

Because collimation error is a function of distance, the sight length for each reading is needed. The error is then stated as ratio (e.g. ft/ft) or angle above (+) or below (-) horizontal.

6. PLANNING AND ORGANIZATION

Action	Activity
Check for	4. Working condition of Dumpy Level. 5. Tripod Legs 6. Level Staff in both unfolded and folded conditions.

For design of Instruction	Read the teaching points carefully.

LABOATORY SHEET 3.5 | Collimation error of Dumpy Level by conducting Reciprocal Leveling

7. SCHEME OF EVALUATION

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	E. Fixing the Tripod on ground. F. Lifting the Dumpy Level from Box / case. G. Fixing the Dumpy Level to Tripod H. Holding the Level Staff	A 1 B 2 C 4 D 3 Total 10	
2.Manipulation Of apparatus	C. Observing the reading from level staff through Dumpy Level D. Measuring the distance between given (two) points	A: 8, B: 7, Tot: 15	

<table>
<tr>
<td>3.Precise Operation / Activity</td>
<td>E. Focusing the Objective Lens
F. Focusing the Eye-piece
G. Leveling the instrument
H. Calculating the collimation error
I. Noting the (observed) reading (from the level staff) in work sheet</td>
<td><table>
<tr><td>A</td><td>5</td></tr>
<tr><td>B</td><td>5</td></tr>
<tr><td>C</td><td>5</td></tr>
<tr><td>D</td><td>3</td></tr>
<tr><td>E</td><td>2</td></tr>
<tr><td>Tot</td><td>20</td></tr>
</table></td>
<td></td>
</tr>
<tr>
<td>4. Values</td>
<td>F. Co-operation
G. Co-ordination
H. Communication
I. Sharing
J. Leadership</td>
<td><table>
<tr><td>A</td><td>1</td></tr>
<tr><td>B</td><td>1</td></tr>
<tr><td>C</td><td>1</td></tr>
<tr><td>D</td><td>1</td></tr>
<tr><td>E</td><td>1</td></tr>
<tr><td>Tot</td><td>5</td></tr>
</table></td>
<td></td>
</tr>
<tr>
<td colspan="2">Total</td>
<td>50</td>
<td></td>
</tr>
</table>

LABORATORY SHEET 3.5

Collimation error of Dumpy Level by conducting Reciprocal Leveling

8. ASSESSMENT QUESTIONS (suggestive only)

(this is for Formative Assessment only)

8. What is collimation error?
9. What is Total Error?
10. What is True Difference?
11. What is Reciprocal Leveling?
12. What is Line of Collimation?
13. What is Reduced Level?
14. Expand G.T.S.
15. What is Bench Mark?
16. What is an adjustment in leveling instrument?
17. What are the methods of calculating reduced levels from observed staff readings?

9. VIVA QUESTIONS (suggestive only)
(this is for Summative Assessment)

The teacher may add questions depending upon the Context of examination

7. What is the Principle of Leveling?
8. What are the Principles of Surveying?
9. Define Surveying.
10. What is the Principle of Chain Surveying?
11. What is the Principle of Compass Surveying?
12. What is a Level Surface?
13. List any three minor instruments.
14. What is focusing of objective?
15. What is focusing of eye piece?
16. What is Leveling of instrument?

LAB SHEET 2.3.6 Profile Levelling

TO PERFORM PROFILE LEVELLING ALONG ROUTE AND CALCULATE THE REDUCED LEVELS

OBJECTIVE

To perform profile leveling along a route

EQUIPMENT/APPARATUS/RESOURSES

11. Dumpy level
12. Levelling staff
13. Chain
14. Ranging rods
15. Tripod stand
16. Arrows

1. TASK ANALYSIS

A. KNOWLEDGE

- Fixing dumpy level on tripod
- Holding the Levelling staff
- Levelling
- Reading values on leveling staff
- Centering
- Back sight
- Intermediate sight
- Fore sight
- Reduced level
- Calculating the Reduced level

B.SKILLS

Category of Skill	Sub task
1. Handling of apparatus	• Fixing the tripod • Setting up the dumpy level on tripod • Holding the Levelling staff • Placing the chain along route
2.Manipulation of apparatus	• Levelling using Tripod legs • Levelling using foot screws • Centering • Adjusting the eyepiece • Adjusting the objective

3. Precise operation /activity	• Sighting the levelling staff • Observing the readings on levelling staff • Noting down the readings in levelling field book • Calculating RLs

LABORATORY SHEET 2.1a

PROFILE LEVELLING

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
12.	Description about Profile levelling G. Importance of Profile levelling H. Applications of Profile levelling	6
13.	Temporary adjustments of levelling	
14.	Entering readings in levelling field book	4
15.	Calculating RL	
16.	Precautions	5
	C. Procedural precautions • Care should be taken while adjusting screws • The instrument should never be kept unguarded or left attended • The instrument should not be set on roads footpaths etc.where movement of men and animal damage the instrument • The distance between instrument and staff should not be too far or too near it results un clear staff readings. • Proper care should be taken in recording the readings in levelling field book	
		15

LABORATORY SHEET 2.1a

PROFILE LEVELLING

3. NEED AND SCOPE OF THE EXPERIMENT

- **I**t is used for determining the levels along a center line of roads, railway lines, canals, sewer lines etc
- As it is run along the center line it is used to determine the undulations of the ground
- It is very useful for determining the relationship between existing ground level and proposed formation level & amount of cutting and filling can be calculated also.
- It is used to find the best economical alignment of road, railway, canal etc.

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	7. Working condition of dumpy level 8. Functioning of screws 9. Tripod stand 10. marked readings on levelling staff
For design of Instruction	Read the teaching points carefully.

LABOATORY SHEET 2.1a

Profile levelling

5. SCHEME OF EVALUATION

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	A. Fixing the tripod B. Setting up the dumpy level on tripod C. Placing the Levelling staff D. Placing the chain along route	A 2 B 4 C 3 D 1 Total 10	
2.Manipulation Of apparatus	A. Levelling using Tripod legs B. Levelling using foot screws C. Centering D. Adjusting the eyepiece E. Adjusting the focusing screw	A 3 B 3 C 5 D 2 E 2 Total 15	
3.Precise Operation/Activity	A. Sigthing the levelling staff B. Observing the reading in levelling staff C. Noting down the readings in levelling field book D. Calculating RLs	A 5 B 5 C 5 D 5 Total 20	
4. Values	K. Co-operation L. Co-ordination M. Communication N. Sharing O. Leadership	A 1 B 1 C 1 D 1 Total 5	
Total		50	

10. ASSESSMENT QUESTIONS (suggestive only)

What is the need of Profile levelling.

11. VIVA QUESTIONS (suggestive only)

- What is the meaning if RL s are increasing or decreasing continuously
- Why we have to start levelling from BM is it compulsory or not?

LAB SHEET 2.3.7 Profile Levelling by taking Cross Sections

OBJECTIVE

To perform profile leveling on either side of a route i.e. at Cross sections

EQUIPMENT/APPARATUS/RESOURCES

17. Dumpy level
18. Levelling staff
19. Chain
20. Ranging rods
21. Tripod stand
22. Arrows

1. TASK ANALYSIS

B. KNOWLEDGE

- Definition of Profile levelling
- Knowledge on Back sight, Bench Mark
- Temporary adjustments of instrument.

B.SKILLS

Category of Skill	Sub task
1. Handling of apparatus	• Fixing the tripod • Setting up the dumpy level on tripod • Holding the Levelling staff • Placing the chain along route • Centering the Instrument
2.Manipulation of apparatus	• Levelling using Tripod legs • Levelling using foot screw • Taking Back sight on Bench Mark • Adjusting the eyepiece • Adjusting the focusing screw
3. Precise operation /activity	• Sigthing the levelling staff • Noting the reading where Center hair Exactly Coincide. • Calculation of RLs at different sections

2. TEACHING POINTS:

S. No.	Teaching points	Suggestive Duration (Min.)
17.	Description about Profile levelling I. Importance of Profile levelling J. Applications of Profile levelling	6
18.	Temporary adjustments in levelling	
19.	Entering readings in levelling field book	4
20.	Calculating RL's	
5.	**Precautions:** • Care should be taken while adjusting screws • The instrument should never be kept unguarded or left attended • The instrument should not be set on roads footpaths etc.where movement of men and animal damage the instrument • The distance between instrument and staff should not be too far or too near it results un clear staff readings. • Proper care should be taken in recording the readings in levelling field book	5
	Total	15

3. NEED AND SCOPE OF THE EXPERIMENT

- **I**t is used for determining the levels along a center line of roads, railway lines, canals, sewer lines etc
- As it is run along the center line it is used to determine the undulations of the ground
- It is very useful for determining the relationship between existing ground level and proposed formation level & amount of cutting and filling can be calculated also.
- It is used to find the best economical alignment of road, railway, canal etc.

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	11. Working condition of dumpy level 12. Functioning of screws 13. Tripod stand 14. marked readings on levelling staff
For design of Instruction	Read the teaching points carefully.

12. ASSESSMENT QUESTIONS (Only suggestive)

- Need of Profile Levelling
- Inference from the profile Drawn

7. VIVA QUESTIONS (Only suggestive. The teacher may add questions depending upon the Context of examination)

- what do you observe if RL's are changing gradually ?
- What do you do if BM has not been sighted after total completion of experiment?
- What is the importance of focusing ?
- What do you infer from the profile you have drawn?

LAB SHEET 2.3.8 To conduct profile levelling along a routeby taking readings along both LS and CS

TASK ANALYSIS

OBJECTIVE : To conduct profile levelling along a routeby taking readings along both LS and CS.

EQUIPMENT: Dumpy level,levelling staff,pegs,plumb bob,tripod,chain/tape,string.

C) Knowledge :

Dumpy level, functions of Dumpy level,adjusting Tripod, steps involved in Temporary adjustments of Dumpy level,placing Plumb bob, fixing Pegs , holding and erecting Levelling staff,sight an object and staff,noting down the readings,calculating RLs
Terminology: Benchmark, Foresight, Back sight,intermediate sight,interval,RL,HI,LS,CS,Profile levelling

D) Skill :

Category of skill	Sub Task
5) Handling of Apparatus	• Fixing the Tripod • Mounting dumpy level on Tripod • Adjusting tripod by Tripod legs for approximate levelling • Holding the levelling staff • Placing plumb bob
6) Manipulation of Apparatus	• Focussing the eye piece • Centring of tripod • Adjusting cross hairs • Adjusting focussing screw • Erecting staff by bubble centre • Making the bubble tube centre by adjusting foot screws
7) Precise Operation	• Accurate levelling • Sighting a object • Observations and tabulations. • Calculating RLs • Plotting graphs by using RLs.
8) Value	• Communication • Cooperation • coordination • Sharing • Leadership

S.no:	Teaching point	Time (min)
1	Functions of Dumpy Level	1
2	Steps involved in temporary adjustments	2
3	Handling the Instrument to take reading by using levelling staff	1
4	Take the B.S,I.S,F.S observed through telescope on levelling staff	1
5	Precautions to be taken in levelling	1
6	The readings are tabulated in notebook	1
7	Calculating RLs	3
8	Plotting graphs for LS and CS	4
9	Observations in profile	1

Conducting Block Levelling for the Given Area

OBJECTIVE

To perform block levelling for the given area by dividing into number of square blocks and taking levels at corners and plot them as contours

EQUIPMENT/APPARATUS/RESOURSES

23. Dumpy Level with Tripod Stand
24. Levelling Staff
25. Ranging rods
26. Pegs
27. Chain
28. Metallic Tape

1. TASK ANALYSIS

C. KNOWLEDGE

- Performing temporary adjustments
- Dividing the given area into uniform square blocks using chain
- Locating the instrument station at suitable position covering entire area
- Observing staff readings
- Calculating the RL's from the obtained staff readings

B.SKILLS

Category of Skill	Sub task
1. Handling of apparatus/tools/material	• Fixing the Tripod • Setting the level on tripod • Levelling the instrument with tripod legs • Holding the levelling staff
2.Manipulation of apparatus	• Eliminating parallax error • Setting up the instrument at suitable position covering the entire area given • Dividing the area into uniform square blocks and marking the corners of the square blocks on given area
3. Precise operation / activity	• Adjusting foot screws for accurate leveling • Taking Back sight, Intermediate sight and Fore Sight readings • Noting down staff readings at respective columns in Field book • Calculating RL's of every staff station • Plotting Contours of equal elevation

2. TEACHING POINTS

S. No.	Teaching points	Suggestive Duration (Min.)
21.	Identifying the component parts of Dumpy Level	4
22.	Studying the Levelling staff	
23.	Definition of Contour and Contour interval	
24.	Selecting suitable position covering the entire area given	6
25.	Performing temporary adjustments	
26.	Dividing the area into uniform square blocks and marking the corner points	
27.	Taking Back sight, Intermediate sight and Fore Sight readings through telescope on levelling staff	
28.	Recording them in level field book and calculating the R.L's of every staff station	
29.	Plotting Contours of equal elevation by the method of squares	4
30.	**Procedural precautions**	
	• Care should be taken that centering and leveling not get disturbed throughout the experiment • Proper care should be taken in recording the readings in field book and calculating the RL's	1
	Total	15

3. NEED AND SCOPE OF THE EXPERIMENT

INDIRECT METHOD OF CONTOURING:

The Indirect methods of contouring are quick, convenient and less expensive. In these methods, spot levels are determined at various points on a series of well laid out lines over the whole area to be contoured.

By Squares:

If the area is not very extensive, this method will be used. The entire area is divided into a number of squares of uniform side vary from 5m to 30m depending upon the nature of ground and contour interval. The important point within the square may be taken when required and located by measurement from the corners.

4. PLANNING AND ORGANIZATION

Action	Activity
Check for	1. Working condition of Dumpy Level 2. Marked readings of Levelling staff 3. Number of links in a chain and length of chain
For design of Instruction	Read the teaching points carefully.

LABOATORY SHEET 3.9

Contouring by Block Levelling

5. SCHEME OF EVALUATION

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus/tools/ material	A. Fixing the Tripod B. Setting the level on tripod C. Levelling the instrument with tripod legs D. Holding the levelling staff	A 2 B 2 C 3 D 3 Total 10	
2.Manipulation of apparatus	A. Eliminating parallax error B. Setting up the instrument at suitable position covering the entire area given C. Dividing the area into uniform square blocks	A 5 B 5 C 5 Total 15	
3.Precise operation / activity	A. Adjusting foot screws for accurate leveling B. Taking Back sight, Intermediate sight and Fore Sight readings C. Noting down staff readings at respective columns in Field book D. Calculating RL's of every staff station E. Plotting Contours of equal elevation	A 2 B 5 C 3 D 5 E 5 Total 20	
4. Values	P. Co-operation Q. Co-ordination R. Communication S. Sharing T. Leadership	5	
Total		50	

13. ASSESSMENT QUESTIONS (Only suggestive)

18. Note down the dimensions of square blocks.
19. Tabulate observations and calculate the RL's.
20. Plot the Contours of given area.

14. VIVA QUESTIONS

(Only suggestive) The teacher may add questions depending upon the Context of examination

17. Define Contour?
18. Define Contour Interval?
19. What are the different methods used for calculating RL's?
20. What is the least count of Levelling staff?
21. Which cross hair reading is to be taken for getting staff reading whether it is central or upper or lower cross hair?
22. When this method of Contouring is adopted?
23. How contours are plotted with known RL's?
24. Is there any disadvantage of plotting a Contour by Squares Method?
25. In Direct or Indirect method of Contouring which one is best suitable?
26. If you forget to take a staff reading of any point can you get the RL of that point?

LOCATING CONTOUR POINTS IN THE FIELD BY RADIAL METHOD

Objective: To perform a task to draw contours by radial method

Apparatus: 1. Dumpy level with tripod stand

2. Plumb bob

3. Levelling staff

4. Prisamatic compass

5. Metallic tape

1. TASK ANALYSIS

A.KNOWLEDGE i. Definition of contour and contour interval

ii.Drawing of contours

B. SKILLS

CATEGORY OF SKILL	SUBTASK
1. Handling of apparatus	A. Centering cab be done with the help of plumb bob B. levelling can be done with the help of foot screws C. Eliminating the parallax by focussing of eyepiece and objective
2.Manipulation of apparatus	A.Bisecting the staff using telescope B.Observing the staff readings C. Recording the values D. Marking the points on the ground
3. Precise operation /activity	A. Calculating the RLs B. Drawing the contours

2. TEACHING POINTS:

S.No	Teaching points	Suggestive duration (min)
1	Definition of contour and contour interval Importance of contours (Applications)	5
2	Explanation of drawing of contours by radial method Limitations of radial method	9
3	Precautions (centering & levelling should not be disturbed)	1
	Total	15 min

3. NEED AND SCOPE OF THE EXPERIMENT:

Direct method of contouring (radial method) is employed for small projects where high accuracy has to be obtained.

4. PLANNING AND ORGANIZATION

Action	Activity
Checked for	Working condition of Dumpy level and levelling staff Rectifying errors if any

5. SCHEME OF EVALUATION

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	A. Centering B. Levelling C. Eliminating of parallax	A B C 5 3 2 (A+B+C=10)	
2.Manipulation Of apparatus	A. Bisecting the staff using telescope B. Observing the staff readings C. Recording the values D. Marking the points on the ground	A B C D 3 5 3 4 (A+B+C+D=15)	
3.Precise Operation/Activity	A. Calculating RLs B. Drawing the contours	A B 5 15 (A+B = 20)	
4. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	Each carries one mark Total 5	
	Total	50	

6. ASSESSMENT QUESTIONS

(1) Tabulate observations made for the experiment

(2) Draw the contours

7. VIVA QUESTIONS

1. Define contour

2. How to calculate Height of instrument?

3. If there is no bench mark in the field how to proceed with the experiment?

4. What are practical applications of contours?

5. What are the demerits of radial method of contouring?

6. Define contour interval

WORK SHEET 3.1.1 Folding and unfolding a chain

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment: **Folding and unfolding a chain**

2. Objective of the experiment: _____

3. Apparatus/Tools required: _____

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)

5. OBSERVATIONS:

6. RESULT:

7. PLOTTING

8. INFERENCE:

8. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS:

9. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Handling of chain
B. folding
C. unfolding</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>4</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>A. Throwing of chain
B. Dragging of chain
C. Pulling of chain</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>A. Making the links free of kinks or bents with the spreading and throwing chain to make straight
B. Commencing from the middle of the chain two pairs of links are to be taken at a time with right hand and placed on left hand alternately in both directions
C. Fastening with leather strap the bunch of links of chain</td><td><table><tr><td>A</td><td>8</td></tr><tr><td>B</td><td>8</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>A. Co-operation
B. Co-ordination
C. Communication
D. Sharing
E. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

WORK SHEET 3.1.2 Direct Ranging

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment: **Perform direct ranging on level ground and measure the distance between two given stations and record the measurements in the field book**

2. Objective of the experiment: _____

3. Apparatus/Tools required: _____

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)

5. OBSERVATIONS:

6. RESULT:_____

_____

7. PLOTTING

8. INFERENCE:_____

_____

_____

_____

_____

8. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS:

_____

_____

_____

9. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Handling of chain
B. Folding and unfolding
C. Handling of Ranging Rods</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>4</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>A. Throwing, Dragging and Pulling of chain
B. Fixing of Ranging Rods perfectly vertical
C. Ranging the Chain line straight</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>A. Making the links free of kinks or bents with the spreading and throwing chain to make straight
B. Fixing the Rods into ground maintaining their plumb
C. Ranging using code of signals</td><td><table><tr><td>A</td><td>8</td></tr><tr><td>B</td><td>8</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>F. Co-operation
G. Co-ordination
H. Communication
I. Sharing
J. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

WORK SHEET 3.1.3 Indirect Ranging

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment: Perform indirect ranging and measure the distance between two given stations when a high ground intervenes to prevent intervisibility of ends of line

2. Objective of the experiment: _____

_____

3. Apparatus/Tools required: _____

_____

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)

5.RESULT:_____

_____

6 SCHEME OF EVALUATION

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	D. Unfolding and folding of chain E. Holding the ranging road straight	5	
2.Manipulation of apparatus	A. Giving Hand signals for ranging the survey line B. Recording the readings in field book C. Measuringthe distance between the points.	15	
3.Precise Operation/Activity	A. Ranging the line B. Laying the chain along the ranging line	25	

4. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
Total		50	

WORK SHEET 3.1.4 set out Right Angle by Chain

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment:set out a right angle to a given chain line by using chain only

2. Objective of the experiment: _____

_____

3. Apparatus/Tools required: _____

_____

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)

5.SKETCH:

6 SCHEME OF EVALUATION

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	A. Unfolding and folding of chain B. Holding the ranging road straight	5	
2.Manipulation of apparatus	A. Use of Pythagoras Theory B Counting of links C Stretching the chain	15	
3.Precise Operation/Activity	A Ranging the line B Setting out point C ,E & D		

			25		
4. Values	F. Co-operation G. Co-ordination H. Communication I. Sharing J. Leadership		5		
Total			50		

WORK SHEET 3.1.5 Set and measure offsets for a given chain line by 1.Perpendicular offsets and 2.Oblique offsets

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment: **Set and measure offsets for a given chain line by 1.Perpendicular offsets and 2.Oblique offsets**

2. Objective of the experiment: _____

3. Apparatus/Tools required: _____

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)

5. OBSERVATIONS:

S.No offset	Types of object to chainage	Length from 1st trail	Length of Offset		
			2nd trail	3rd trail	Average
I.1.	Perpendicular	O.P=	m	m	m
2	Perpendicular	O.A=	m	m	m
3	Perpendicular	O.B=	m	m	m
II.1.	Oblique offset	ap=	m	m	m
2	Oblique offset	bp=	m	m	m

6. RESULT:

7. PLOTTING

8. INFERENCE:

8. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS:

9. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>D. Handling of chain and Tape
E. Handling of Ranging Rods
F. Handling of Cross Staff</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>4</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>D. Throwing, Dragging and Pulling of chain
E. Fixing of Ranging Rods and Cross Staff perfectly vertical
F. Unwinding and winding of Tape</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>D. Making the links free of kinks or bents with the spreading and throwing chain to make straight
E. Fixing the Rods and Cross staff into ground maintaining their plumb
F. Holding the Tape at the correct points</td><td><table><tr><td>A</td><td>8</td></tr><tr><td>B</td><td>8</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>K. Co-operation
L. Co-ordination
M. Communication
N. Sharing
O. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

WORK SHEET 3.1.6 Perform triangulation survey of a given area with chain and cross staff and record all necessary details

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment: **Perform triangulation survey of a given area with chain and cross staff and record all necessary details**

2. Objective of the experiment: _____

3. Apparatus/Tools required: _____

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)

5. OBSERVATIONS:

6. RESULT:

7. PLOTTING

8. INFERENCE:

8. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS:

_____

_____

_____

9. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Handling of chain and Tape
B. Handling of Ranging Rods
C. Handling of Cross Staff</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>4</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>G. Throwing, Dragging and Pulling of chain
H. Fixing of Ranging Rods and Cross Staff perfectly vertical
I. Unwinding and winding of Tape</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>G. Making the links free of kinks or bents with the spreading and throwing chain to make straight
H. Fixing the Rods and Cross staff into ground maintaining their plumb
I. Establishing Survey Stations and lines</td><td><table><tr><td>A</td><td>8</td></tr><tr><td>B</td><td>8</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>P. Co-operation
Q. Co-ordination
R. Communication
S. Sharing
T. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

WORK SHEET 3.1.7 Calculation of the area by chain triangulation

Name of the student	**Date of experiment**
PIN	**BRANCH**
Institution	**Experiment No.**

1. Title of the experiment: **Calculation of the area by chain triangulation.**

2. Objective of the experiment**: To performs to measure and calculate the area bounded by the given**

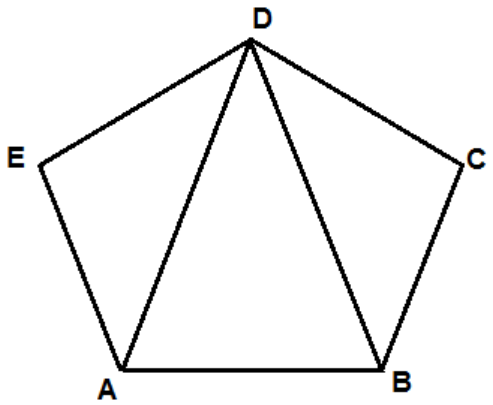
Points by chain Triangulation

3. Apparatus/Tools required: Chain, Tape, Ranging rods, Arrows

4. PROCEDURE:

1. Select three survey stations A,B and C such that from each survey station the other two stations are visible.
2. Fix the ranging rods at A,B , C, D, and E
3. Run a Chain line through the center of area which divided into a no. of Triangles.
4. Measure the lengths AB,BC,CD,DE,EA,AD and BD
5. Plot the survey to a suitable scale after the field work is over
6. Calculate the area of a field is calculated.
7. Draw a complete figure in field book using field observation.

FIGURE:



5. OBSERVATIONS:

S.NO.	Figure	Length(m) (a)	width(m) (b)	height(m) (c)	perimeter(m) S=(a+b+c}/2	Area(M2)	Remarks
1							
2							
3							
4							
5							
6							
7							

6. SPECIMEN CALCULATIONS:

S=(a+b+c)/2 = a,b,c are the sides of the triangle

Area of triangle = $\sqrt{\{ S(S-a)(S-b)(S-c) \}}$

7. RESULT:

Area of the field : Sq.m

8. INFERENCE:

9. DEFICIENIES/MALFUNCTIONING OF ANY APPARATUS:

10. SCHEME OF EVALUATION:

Category of skill	Sub Task	Weight with Competency level individually	Awarded (50)

1.Handling of apparatus	A. Using the Ranging rods B. To Run a chain line C. To fixes the arrow vertically into the ground D. Using the tape	10	
2.Manipulation Of apparatus	A. The Ranging rods are to be Fixed at each end of the line B. To Divided into no. of Triangles C. To Measure the Triangles area . D.To Plotting the field.	15	

3.Precise Operation/Activity	A. Calculate the triangle area B. Calculate the Total field area. C. Draw the complete figure in Field book.	20	
4. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
	Total	50	

WORK SHEET 3.1.8 Calculation of the area by chain and Cross Staff

WORK SHEET

Name of the student	**Date of experiment**
PIN **BRANCH**	
Institution	**Experiment No.**

1. Title of the experiment: **Calculation of the area by Cross Staff Method using chain and Cross Staff**

2. Objective of the experiment: To conduct Chain surveying using Cross Staff Method and to calculate

the area bounded by the given points

3. Apparatus/Tools required: Chain, Tape, Ranging rods, Arrows, Cross Staff.

4. PROCEDURE:

1 This Survey is carried out to locate the boundaries of a field

2. Fix the ranging rods at boundaries of a survey line

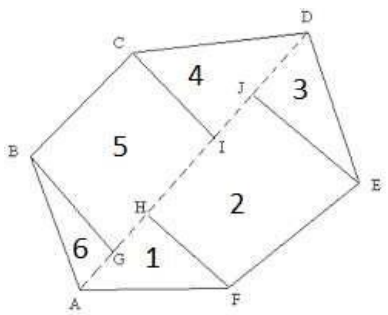
3. The offsets to the boundary are taken in order to their chainages as shown.

3. A Chain line is run through the center of area which divided into a no. of Triangles and Trapezoids

4. After the field work is over the survey is plotted to a suitable scale

5. Then the area of a field is calculated as shown in tabular column.

6. Draw a complete figure in field book using field observation.



5. OBSERVATION:

S.NO.	Figure	Chainage(m)	Base(m)	Offsets (m)	Mean offset(m)	Area(Sq m)	Remarks
1							
2							
3							
4							
5							
6							
7							

6. RESULT:

Area of the field : Sq.m

7. INFERENCE:

8. DEFICIENIES/MALFUNCTIONING OF ANY APPARATUS:

9. SCHEME OF EVALUATION:

Category of skill	Sub Task	Weight with Competency level individually	Awarded (50)
1.Handling of apparatus	A. Using the Ranging rods B. To Run a chain line C. Using the Cross staff D. Using the tape	10	
2.Manipulation Of apparatus	A. The Ranging rods are to be Fixed at each end of the line B. To Divided into no. of Triangles And Trapezoids C. To Measure the field area . D.To Plotting the field.	15	
3.Precise Operation/Activity	A. Calculate the Trapezoidal area B. Calculate the Total field area. C. Draw the complete figure in Field book.	20	
4. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
	Total	50	

WORK SHEET 3.1.9 CARRYING OUT CHAIN SURVEY TO OVERCOME OBSTACLES

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment: CARRYING OUT CHAIN SURVEY TO OVERCOME OBSTACLES

2. Objective of the experiment: _____

3. Apparatus/Tools required: _____

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)

5. OBSERVATIONS:

6. RESULT:

7. PLOTTING

8. INFERENCE:

8. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS:

9. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>F. Using chain/ tape for measuring length
G. Using ranging rods for ranging/prolonging a line
H. Using cross staff for erecting perpendicular.</td><td><table><tr><td>A</td><td>3</td></tr><tr><td>B</td><td>3</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>D. Measuring length using tape/chain
E. Erecting of perpendicular and Ranging/Prolonging a line
F. Reading values carefully</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>D. Erecting perpendicular
E. Ranging/Prolonging a line
F. Applying appropriate formula to calculate the length of object
G. plotting
H. Compare results by plotting</td><td><table><tr><td>A</td><td>4</td></tr><tr><td>B</td><td>4</td></tr><tr><td>C</td><td>4</td></tr><tr><td>D</td><td>4</td></tr><tr><td>E</td><td>4</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
</table>

4. Values	U. Co-operation V. Co-ordination W. Communication X. Sharing Y. Leadership	5	
Total		50	

WORK SHEET 3.1.10 Carrying out chain traversing

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment: Carrying out chain traversing to survey an area bounded by more than three staions

2. Objective of the experiment: _____

_____

3. Apparatus/Tools required: _____

_____

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)

5. OBSERVATIONS:

S.NO	Name of figure	Chainage (m)	Base (m)	Offsets (m)	Mean (m)	Area (m2)

6. RESULT:_____

_____

7. PLOTTING

8. INFERENCE:_____

_____

_____

_____

_____

9. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS:

_____

_____

9. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>I. Using chain/ tape for measuring length
J. Using ranging rods for ranging/prolonging a line
K. Using cross staff for erecting perpendicular.</td><td><table><tr><td>A</td><td>3</td></tr><tr><td>B</td><td>3</td></tr><tr><td>C</td><td>4</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>G. Measuring length using tape/chain
H. Erecting of perpendicular and Ranging/Prolonging a line
I. Reading values carefully</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>I. Erecting perpendicular
J. Ranging/Prolonging a line
K. Applying appropriate formula to calculate the length of object
L. plotting
M. Compare results by plotting</td><td><table><tr><td>A</td><td>4</td></tr><tr><td>B</td><td>4</td></tr><tr><td>C</td><td>4</td></tr><tr><td>D</td><td>4</td></tr><tr><td>E</td><td>4</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>Z. Co-operation
AA.Co-ordination
BB.Communication
CC. Sharing
DD. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

WORK SHEET

Name of the student:		Date of exercise:
PIN:	Branch:	
Institution:		Exercise No:

1. TITLE OF THE EXERCISE: IDENTIFYING PARTS & TEMPORARY ADJUSTMENTS OF PRISMATIC COMPASS

2. APPARATUS/TOOLS REQUIRED:

3. FIELD SKETCH/ ROUGH SKETCH

1. Procedure
   1. .....
   2. .....
   3. .....
   4. .....

WORK SHEET 3.1a

Setting up the compass and observation of bearing

7. OBSERVATIONS:

$$W.C.B\ of\ a\ Line =$$

$$\therefore Reduced\ Bearing\ of\ the\ Line =$$

S.no	Station	Line	W.C.B

SPECIMENS CALCULATIONS

8. COMMENTS/REMARKS

9. SCHEME OF EVALUATION

Category of skill	Sub Task	Weight with competency level Individually	Awarded (50)
1. Handling of instrument	A. Drawing rough sketch of object points from the station B. Identifying the parts of a compass C. Unfolding object vane and D. eye vane E. Focusing the prism	10	
2.Manipulation of instrument	A. Prepare the instrument byCentering and Levelling B. Focusing of the object through eye vane and object vane. C. Reading of the bearing on Graduated circle.	15	
3.Precise Operation/Activity	A. Reading the graduated circle from Magnetic North B. Measuring the bearing on Graduated ring C. Recording the bearings in field book		

	D. Calculating the Reduced bearings from Whole Circle Bearings	20	
4. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
Total		50	

Signature of the student	Signature of the lecturer

WORK SHEET 3.2.3 Calculation of Include Angle using Compass

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the Exercise: Calculation of Include Angle using Compass

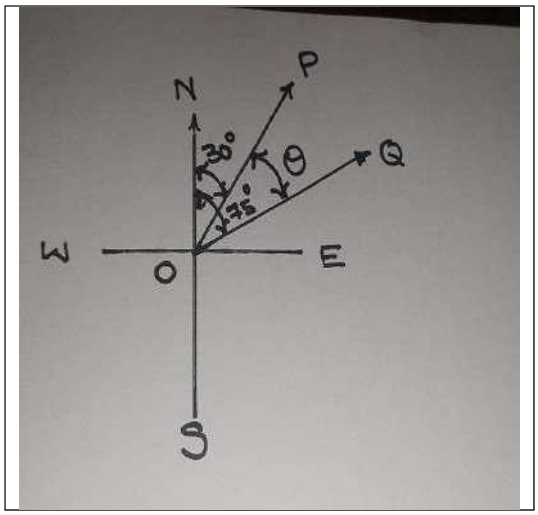
2. Objective of the Exercise: Performing compass survey to determine included angle by. taking of bearings of two points from instrument station

3. Apparatus/Tools required: Prismatic compass, ranging rods, arrows and ranging rods

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)
9)

5. Field Sketch



6. OBSERVATIONS:

Bearing of line OP

Bearing of line OQ

7. SPECIMENS CALCULATIONS

8. RESULT: _____

9. Inference:

10. Deficiencies/Malfunctioning of any apparatus

11. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>● Bringing the instrument from laboratory to the field
● Unfolding and spreading the tripod
● Adjusting the tripod legs
● Using plum bob for centering
● Fixing the compass on tripod
● Fixing the ranging rod on selected station point
● Folding and unfolding of object vane
● Removing the compass from tripod, placing it in box after completion of work
● Folding the tripod
● Pressing the break pin</td><td><table><tr><td>A</td><td>1</td></tr><tr><td>B</td><td>1</td></tr><tr><td>C</td><td>1</td></tr><tr><td>D</td><td>1</td></tr><tr><td>E</td><td>1</td></tr><tr><td>F</td><td>1</td></tr><tr><td>G</td><td>1</td></tr><tr><td>H</td><td>1</td></tr><tr><td>I</td><td>1</td></tr><tr><td>J</td><td>1</td></tr><tr><td>Tot</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>● Checking whether magnetic needle freely moving showing the direction
● Adjusting the prism
● Leveling compass
● Swinging the compass towards next point and sighting</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>2</td></tr><tr><td>C</td><td>3</td></tr><tr><td>D</td><td>3</td></tr><tr><td>Tot</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation/Activity</td><td>A. Sighting towards object
B. Intersecting the object
C. Focusing the Prism
D. Observing the bearing on graduated ring
E. Computing the included angle</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>3</td></tr><tr><td>C</td><td>3</td></tr><tr><td>D</td><td>6</td></tr><tr><td>E</td><td>6</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>A. Co-operation
B. Co-ordination
C. Communication
D. Sharing
E. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

Signature of the student. Signature of the Lab in charge

WORK SHEET 3.2.4 Open Traverse

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. **AN OPEN TRAVERSE WITH COMPASS AND CHAIN**

. 2. **OBJECTIVE OF THE EXPERIMENT**: To perform an open traverse survey formed by series of connected straight lines with Compass and Chain.

3. APPARATUS/TOOLS REQUIRED:

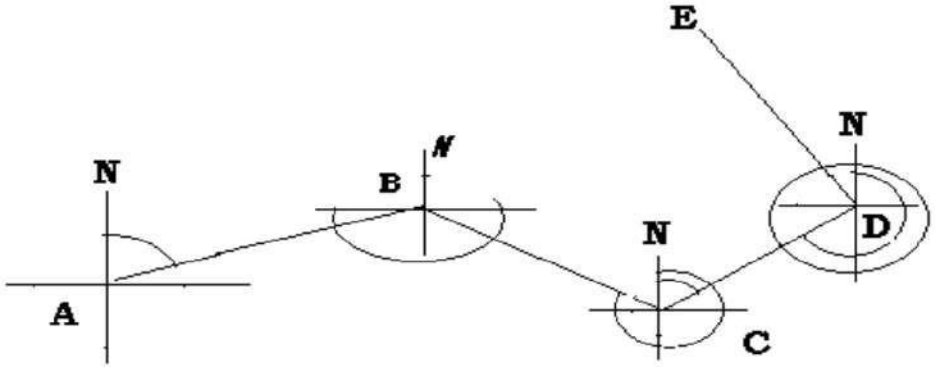
1. Prismatic Compass
2. Tripod
3. Tape
4. Chain
5. Arrows
6. Ranging Rods

4. PROCEDURE:

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

4. FIELDSKETCH:

SKETCH:



5. OBSERVATIONs & FIELD DATA::

SL.NO.	LINE	LENGTH	F,B	B.B	Remarks
1	AB				
2	BC				
3	CD				
4	DE				

6. SPECIMENS CALCULATIONS:

Fore bearing of line AB, BC, CD and DE

Back bearing of line AB, BC and CD

Difference between the bearings of lines AB and BA = 180^0

7. RESULT:_____

8. INFERENCE:

_____

_____

_____

_____

_____

9. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS:

_____

_____

_____

10. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr>
<td>1. Handling of apparatus</td>
<td>A. Bringing the instrument from laboratory to the field
B. Unfolding and spreading the Tripod
C. Adjusting the tripod legs
D. Using plum bob for centering
E. Fixing the compass on tripod
F. Fixing the ranging rod on selected station points
G. Folding and unfolding of object vane
H. Removing the compass from tripod ,placing it in box after completion of work
I. Folding the tripod
J. Pressing the break pin</td>
<td>
<table>
<tr><td>A</td><td>2</td></tr>
<tr><td>B</td><td>1</td></tr>
<tr><td>C</td><td>2</td></tr>
<tr><td>D</td><td>2</td></tr>
<tr><td>E</td><td>1</td></tr>
<tr><td>F</td><td>2</td></tr>
<tr><td>G</td><td>1</td></tr>
<tr><td>H</td><td>2</td></tr>
<tr><td>I</td><td>1</td></tr>
<tr><td>J</td><td>1</td></tr>
<tr><td>Total</td><td>15</td></tr>
</table>
</td>
<td></td>
</tr>
<tr>
<td>2.Manipulation Of apparatus</td>
<td>A. Checking whether magnetic needle freely moving showing the direction
B. Adjusting the prism
C. Leveling compass
D. Swinging the compass towards next point and sighting</td>
<td>
<table>
<tr><td>A</td><td>B</td><td>C</td><td>D</td><td>Tot</td></tr>
<tr><td>2</td><td>2</td><td>3</td><td>3</td><td>10</td></tr>
</table>
</td>
<td></td>
</tr>
<tr>
<td>3.Precise Operation/Activity</td>
<td>A. Sighting towards object
B. Intersecting the object
C. Focusing the Prism
D. Observing the bearing on graduated ring
E. Recording the Fore Bearing and Back Bearing</td>
<td>
<table>
<tr><td>A</td><td>2</td></tr>
<tr><td>B</td><td>3</td></tr>
<tr><td>C</td><td>3</td></tr>
<tr><td>D</td><td>6</td></tr>
<tr><td>E</td><td>9</td></tr>
<tr><td>Tot</td><td>20</td></tr>
</table>
</td>
<td></td>
</tr>
</table>

4. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
Total		50	

Signature of the student	Signature of the Teacher

WORK SHEET 3.2.5 Closed traverse with Prismatic Compass and Chain

WORK SHEET

Name of the student:		Date of exercise:
PIN:	Branch:	
Name of the Institution:		Exercise No:

1. **Title of the exercise:** Perform Closed traverse with Prismatic Compass and Chain.

2. **Objective of the exercise**:

_____

_____

3. **Apparatus/Tools required**:

_____

_____

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)
9)
10)
11)

12)
13)
14)

5. OBSERVATIONS:

Line	Length (m)	Fore Bearing	Back Bearing	Difference
1	AB			
2	BC			
3	CD			
4	DE			
5	EA			

6. SAMPLE CALCULATIONS:

Included angle ∠A =

Check = Sum of included angles = (2n – 4) x 90 =

7. RESULT:

_____

_____

8. INFERENCE:

_____

_____

_____

_____

9. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS: _____

_____

_____

_____

10. SCHEME OF EVALUATION:

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	A. Use of Ranging rods or arrows for establishing the Traverse Stations. B. Folding and unfolding of Chain and fully extending it for measuring lengths C. Using arrows at the end of chain for continuation of chain line D. Using the tape for Measuring small lengths. E. Setting up Prismatic compass over stations and performing temporary adjustments.	10	
2.Manipulation ofapparatus	A. Giving identification marks to stations. B. Attaching Flags to ranging rods Flips or Tags to arrows. C. Stretching the chain straight and extending fully. D. Checking for any kinks or bent in links. E. Fixing the Ranging rods firmly and vertically. F.Setting the compass and adjusting perfectly.	12	
3.Precise Operation/Activity	A. Using Ranging rods for ranging the line if length exceeds that of chain length. B. Measuring the lengths correctly with chain C. Observing the bearings with prismatic compass D. Calculating the included angles and checking them E. Plotting the traverse and finding the area	23	
4. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	05	
Total		50	

Signature of the student	Signature of the Teacher

WORK SHEET 3.2.6 Plotting the closed traverse from field data and adjusting for closing error by Bowditch rule

WORK SHEET

Name of the student:		Date of exercise:
PIN:	Branch:	

Institution:	Exercise No:

1. **Title of the exercise:** Plotting the closed traverse from field data and adjusting for closing error by Bowditch rule

2. Objective of the exercise:

_____

_____

3. Apparatus/Tools required:

_____

_____

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)
9)
10)

5. OBSERVATIONS: (Field Data)

Line	Length (m)	Fore Bearing	Back Bearing
AB			
BC			

CD			
DE			
EA			

6. SAMPLE CALCULATIONS:

Check = BB - FB =

7. RESULT:

Length of closing error = m

_____
_____

8. INFERENCE:

_____
_____
_____
_____
_____

9. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS:

_____
_____
_____

10. SCHEME OF EVALUATION:

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)

1. Handling of apparatus	A. Fixing a drawing sheet to drawing board B. Fixing a Mini drafter to drawing board C. Keeping smooth side of drawing sheet up	10	
2.Manipulation ofapparatus	A. Using the drawing tools correctly to plot. B. Drawing the lines sharply with uniform stroke with pencil C. Keeping the sheet clean without strains D. Adopting a suitable scale	12	
3.Precise Operation/Activity	A. Marking the lengths and angles correctly with appropriate drawing tools B. Plotting the traverse neatly C. Measuring closing error D. Adjusting closing error using Bowditch's graphical method E. Replotting with error adjusted	23	
4. Values	F. Co-operation G. Co-ordination H. Communication I. Sharing J. Leadership	05	
Total		50	
Signature of the student		Signature of the Teacher	

WORK SHEET 3.2.7 To determination of area by method of radiation.

WORK SHEET

Name of the student:		Date of exercise:
PIN:	Branch:	
Institution:		Exercise No:

1). TITLE OF THE EXERCISE: To determine the area bounded by the given points by the method of radiation.

2) OBJECTIVE OF THE EXERCISE:

---

3). APPARATUS/TOOLS REQUIRED:

---

4).PROCEDURE

5).FIELD SKETCH:

6). OBSERVATIONS:

Line	Length(m)	Magnetic bearing	Included angle	Component triangle area(sq.mt)	Total area (sq.mt)

7) SAMPLE CALCULATION:

Included angle(θ_1)=

Component triangle area (A_1) =

Similarly area of other component triangles can be calculated.

8) RESULT:

Total area bounded by given points =

10) INFERENCE:

---

11) DEFICIENCIES / MALFUNCTIONING OF ANY APPARATUS:

---

12. SCHEME OF EVALUATION:

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	A. Use of Ranging rods or arrows for establishing the given stations. B. Folding and unfolding of Chain and fully extending it for measuring lengths C. Using arrows at the end of chain for continuation of chain line D. Using the tape for Measuring small lengths. E. Setting up Prismatic compass and performing temporary adjustments	Total 10	
2.Manipulation of apparatus	G. Giving identification marks to stations. H. Attaching Flags to ranging rods Flips or Tags to arrows. I. Stretching the chain straight and extending fully. J. Checking for any kinks or bent in links. K. Fixing the Ranging rods firmly and vertically. L. Setting the compass and adjusting perfectly.	Total 10	
3.Precise Operation/Activity	A. Using Ranging rods for ranging the line if length exceeds that of chain length. B. Measuring the lengths correctly with chain C. Observing the bearings with prismatic compass D. Calculating the included angles and checking them E. Calculation of component triangle area & total area F. Plotting the area bounded by given points	Total 25	

4. Values	F. Co-operation. G. Co-ordination. H. Communication. I. Sharing. J. Leadership.	5	
Total		50	

Signature of the Student	**Signature of Lecturer**

WORK SHEET 3.2.8 Distance between two accessible points by single setting of the Prismatic Compass

WORKSHEET

Name of the student:		Date of Exercise:
PIN:	Branch:	
Institution:		Exercise No:

1. **Title of the exercise:** To determine the distance between two accessible points involving single setting of the instrument.
2. **Objective of the exercise:**

3. **Apparatus/Tools required:**

4. **Procedure:**

1)
2)
3)
4)
5)
6)
7)
8)
9)
10)

5. **Observations:**

Whole bearing of OA is α =

Whole bearing of OB is β =

$\Theta = 360^{o} - \alpha + \beta =$

Length of OA=

Length of OB=

AB= $(OB^2+OA^2-2*OA*OB*\text{Cos}\ \theta)^{½}$=

6. RESULT:

7. Inference:

8. Deficiencies/ malfunctioning of any apparatus:

9. Scheme of Evaluation:

Category of Skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	A. Centering the tripod stand B. Leveling the compass C. Focusing the prism		

2. Manipulation of apparatus	A. Sighting the ranging rod and observing the bearing of the line. B. Measurement of distance between ranging rod and instrument using tape	20	
3. Precise Operation/ Activity	A. Calculation of angle θ. B. Calculation of length AB	10	
4. Values	1.Co-operatio 2. Co-ordination 3. Communication 4.Sharing 5. Leadership	5	
Total		50	
Signature of student		Signature of Teacher	

WORK SHEET

Name of the student		Date of exercise
PIN:	Branch:	
Institution:		Exercise No:

1. TITLE OF THE EXERCISE: **THE HORIZONTAL DISTANCE BETWEEN TWO INACCESSIBLE POINTS- COMPASS SURVEY**

2. OBJECTIVE OF THE EXERCISE:

3. APPARATUS/ TOOLS REQUIRED:

4. PROCEDURE:

5. OBSERVATIONS:

1. Least count of compass : _____
2. Distance AB =_____m

Instrument at	Sighted to	Line	Bearing
A	P	AP	
	Q	AQ	
	B	AB	
B	P	BP	
	Q	BQ	
	A	BA	

6. SAMPLE CALCULATIONS:

7. RESULT:

8. INFERENCE:

9. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS:

10. SCHEME OF EVALUATION

S.No.	Category of skill	Sub task	Weigh with competency level individually	Awarded (40)
1	Handling the apparatus	A. Boxing and unboxing of compass B. Clamping the compass securely to the tripod stand. C. Folding and unfolding of chain/tape.	5	
2	Manipulation of apparatus	A. Centering the compass (by using plumb bob or a small stone) B. Levelling the instrument with the help of ball and socket arrangement. C. Adjustment of prism till the readings on the graduated ring appear clear and sharp.	12	
3	Precise operation/	A. Conducting Reconnaissance 1) To set the station such that	18	

	activity	intervisibility of points/stations is achieved. 2) to confirm the stations are free from magnetic substances B. Preparation of index sketch C. Marking station on the ground D. Bisecting the ranging rod at the required point through the object vane. (after centering and levelling) E. Measurement of bearings.		
4	Values	A. Cooperation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
Total			40	
Signature of the student:			Signature of the staff member:	

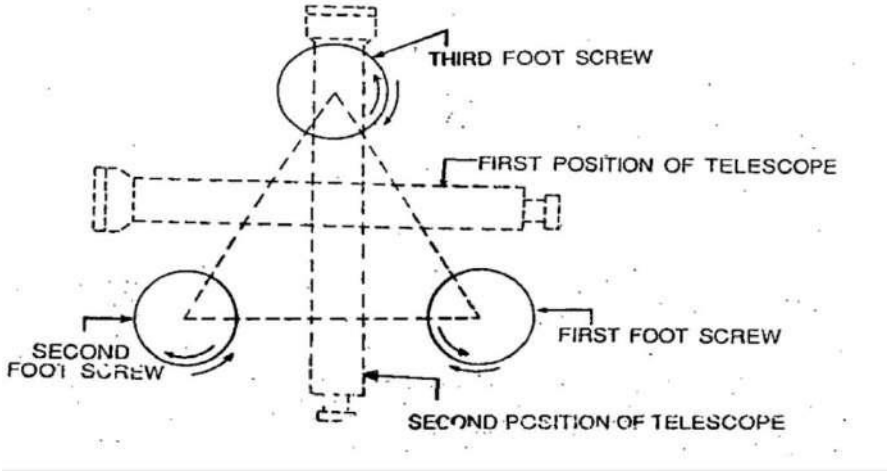
WORK SHEET 3.3.2 Performing the temporary adjustments of dumpy level in surveying

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. **Objective of the experiment:** Performing the temporary adjustments of dumpy level in surveying
2. **Apparatus/Tools required:** Dumpy level, plumb bob, pegs, levelling staff.

3. Rough Sketch:



4. Team members:

5. Distribution of Work:

S.no.	Name of the student	Work allotted/performed	Time

6. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)
9)
10)
11)
12)

7. OBSERVATIONS/tabulations:

station	B.S	I.S	F.S	H.I	R.L	Remarks	
A							
B							
C							
D							
E							
F							

G							
Sum							

8. Remarks/comments:

9. **RESULT**:_____

_____

10. CERTIFICATION:

Signature of the student Signature of the Lecturer

WORK SHEET 3.3.3 Differential Levelling Using Dumpy Level

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment: Difference in Elevation between Two Stations Using Differential Levelling

2. Objective of the experiment: _____

3. Apparatus/Tools required: _____

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)

WORK SHEET 3.30

Differential Levelling

5. OBSERVATIONS:

a) AX = _____

b) BY = _____

c) E(A) = BM = Known Value

Point	BS	HI	FS	SS	Elevation

C. CALCULATIONS

a) AX = _____

b) BY = _____

c) BC = AX - BY = _____

d) E(A) = BM = Known Value

e) HI = BS + E(A)

f) E(B) = HI – FS

WORK SHEET 3.30

Differential Levelling

6. RESULT:_____

_____

7. INFERENCE:_____

_____
_

_____
_

_____
_

_____
_

8. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS:
_____

_____
_

_____
_

WORK SHEET 3.30

Differential Levelling

9. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Fixing the Tripod on ground.
B. Lifting the Dumpy Level from Box / case.
C. Fixing the Dumpy Level to Tripod
D. Holding the Level Staff</td><td><table><tr><td>A</td><td>1</td></tr><tr><td>B</td><td>2</td></tr><tr><td>C</td><td>4</td></tr><tr><td>D</td><td>3</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>A. Centering the bubble
B. Observing the reading from level staff through Dumpy Level</td><td><table><tr><td>A</td><td>B</td><td>Tot</td></tr><tr><td>8</td><td>7</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation / Activity</td><td>A. Focusing the Objective Lens
B. Focusing the Eye-piece
C. Leveling the instrument
D. Noting the (observed) reading (from the level staff) in work sheet</td><td><table><tr><td>A</td><td>5</td></tr><tr><td>B</td><td>5</td></tr><tr><td>C</td><td>5</td></tr><tr><td>D</td><td>5</td></tr><tr><td>Total</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>A. Co-operation
B. Co-ordination
C. Communication
D. Sharing
E. Leadership</td><td><table><tr><td>A</td><td>1</td></tr><tr><td>B</td><td>1</td></tr><tr><td>C</td><td>1</td></tr><tr><td>D</td><td>1</td></tr><tr><td>E</td><td>1</td></tr><tr><td>Total</td><td>5</td></tr></table></td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

WORK SHEET 3.3.4 Reciprocal Levelling

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment: True difference in elevation between two far off station points by Reciprocal Levelling.

2. Objective of the experiment: _____

3. Apparatus/Tools required: _____

4. Rough Sketch / Field Sketch:

5. Distribution of Work (If Given)

Sl.No	Name of the Student	Work Allotted / Performed	Time		When did he do
			From	To	
1					
2					
3					

4					
5					
6					

6. PROCEDURE: (Simple Sentences not exceeding 15 points)

1)
2)
3)
4)
5)
6)
7)
8)
9)
10)
11)
12)
13)
14)
15)

7. OBSERVATIONS AND TABULATIONS:

When the level is nearer to A

Correct staff reading at Aa1=m

Staff reading at B b1= m

When the level is nearer to B

Correct staff reading at B b2=m

Staff reading at A a2=m

CALCULATIONS :

h= True difference of level between A & B

When the level is nearer to A

Correct staff reading at Aa1=m

Staff reading at B b1= m

When the level is nearer to B

Correct staff reading at B b2=m

Staff reading at A a2=m

$$h = \frac{(a1-b1)+(a2-b2)}{2}$$

RL of B = RL of A + h

8. COMMENTS / REAMRKS:_____

_____

_____

_____

_____

WORK SHEET 3.4

True Level difference by conducting Reciprocal Levelling

9. SCHEME OF EVALUATION

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	A. Setting Dumpy level on tripod stand B. Centering the instrument by using the Plumb bob. C .Levelling the instrument using foot screws D. Elimation of parallex by focusing eye piece and objective	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>Total</td></tr><tr><td>1</td><td>3</td><td>3</td><td>3</td><td>10</td></tr></table>	
2.Manipulation of apparatus	A. Bisecting the Staff using telescope B. Observing staff readings by focussing the telescope C. Noting the staff readings	<table><tr><td>A</td><td>B</td><td>C</td><td>Tot</td></tr><tr><td>5</td><td>5</td><td>5</td><td>15</td></tr></table>	
3.Precise Operation/Activity	A. Calculation of True elevation difference B. Calculation of R.L of B	A= 15 m B= 5 m	
4. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	Each carries one mark Total = 5 m	

Total	50	

Signature of the Student **Signature of the Faculty Member**

WORK SHEET 3.3.5 Collimation error of Dumpy Level by conducting Reciprocal Levelling

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment: Collimation error of Dumpy Level by conducting Reciprocal Levelling

2. Objective of the experiment: _____

3. Apparatus/Tools required: _____

4. PROCEDURE:

1)
2)
3)
4)
5)
6)
7)
8)
9)
10)
11)
12)
13)
14)
15)

WORK SHEET 3.5

Collimation error of Dumpy Level by conducting Reciprocal Levelling

5. OBSERVATIONS:

a_1 =_____m, a_2 =_____m,

b_1 =_____m, b_2 =_____m and

d =_____m (distance between A and B)

S. No	Instrument at	Height of Instrument (m)	Staff above peg (m)	Staff reading	RL (m)
1					
2					

CALCULATIONS

$$e = \frac{(b_1 - a_1) - (b_2 - a_2)}{2}, \qquad d = \frac{(b_1 - a_1) + (b_2 - a_2)}{2}$$

Collimation error, $e_l = e - 0.0673 * d^2$

RL of B = RL of A + d

WORK SHEET 3.5

Collimation error of Dumpy Level by conducting Reciprocal Levelling

6. RESULT:

7. INFERENCE:

8. DEFICIENCIES / MALFUNCTIONING OF ANY APPARATUS:

WORK SHEET 3.5

Collimation error of Dumpy Level by conducting Reciprocal Levelling

9. SCHEME OF EVALUATION

<table>
<tr><th>Category of skill</th><th>Sub Task</th><th>Weight with competency level individually</th><th>Awarded (50)</th></tr>
<tr><td>1. Handling of apparatus</td><td>E. Fixing the Tripod on ground.
F. Lifting the Dumpy Level from Box / case.
G. Fixing the Dumpy Level to Tripod
H. Holding the Level Staff</td><td><table><tr><td>A</td><td>1</td></tr><tr><td>B</td><td>2</td></tr><tr><td>C</td><td>4</td></tr><tr><td>D</td><td>3</td></tr><tr><td>Total</td><td>10</td></tr></table></td><td></td></tr>
<tr><td>2.Manipulation Of apparatus</td><td>C. Observing the reading from level staff through Dumpy Level
D. Measuring the distance between given (two) points</td><td><table><tr><td>A</td><td>B</td><td>Tot</td></tr><tr><td>8</td><td>7</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise Operation / Activity</td><td>E. Focusing the Objective Lens
F. Focusing the Eye-piece
G. Leveling the instrument
H. Calculating the collimation error
I. Noting the (observed) reading (from the level staff) in work sheet</td><td><table><tr><td>A</td><td>5</td></tr><tr><td>B</td><td>5</td></tr><tr><td>C</td><td>5</td></tr><tr><td>D</td><td>3</td></tr><tr><td>E</td><td>2</td></tr><tr><td>Tot</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>F. Co-operation
G. Co-ordination
H. Communication
I. Sharing
J. Leadership</td><td><table><tr><td>A</td><td>1</td></tr><tr><td>B</td><td>1</td></tr><tr><td>C</td><td>1</td></tr><tr><td>D</td><td>1</td></tr><tr><td>E</td><td>1</td></tr><tr><td>Tot</td><td>5</td></tr></table></td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

WORK SHEET 3.3.6 Profile Levelling by taking Longitudinal Sectioning

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment:

2. Objective of the experiment: _____

_____

3. Apparatus/Tools required: _____

_____

4.Field sketch:

5.Team members

6.Distribution of work

SNO	NAME OF THE STUDENT	WORK ALOTTED	TIME		REMARKS
			FROM	TO	

7. PROCEDURE:

1)

2)
3)
4)
5)
6)
7)
8)

WORK SHEET

PROFILE LEVELLING

8. TABULATIONS &CALCULATIONS:

Station	Staff	Distance In meters	Staff Reading			Height of Instrument or		Reduced Level	Remarks
			Back (B.S)	Inter (I.S)	Fore (F.S)	Rise	Fall		

CHECK

RESULT:_____

_____

9. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS:

_____

_____

_____

10. SCHEME OF EVALUATION

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)

1. Handling of apparatus	A. Fixing the tripod B. Setting up the dumpy level on tripod C. Holding the Levelling staff D. Placing the chain along route	10	
2.Manipulation of apparatus	A. Levelling using Tripod legs B. Levelling using foot screws C. Centering D. Adjusting the eyepiece E. Adjusting the objective	15	
3.Precise Operation/Activity	A. Sighting the levelling staff B. Observing the readings on levelling staff C. Noting down the readings in levelling field book D. Calculating RLs	20	
4. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
Total		50	

Signature of student

Signature of Lecturer

WORK SHEET 3.3.7 Profile Levelling by taking Cross Sections

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment:

2. Objective of the experiment: _____

3. Apparatus/Tools required: _____

4.Field sketch:

5.Team members

5.Distribution of work if any

SNO	NAME OF THE STUDENT	WORK ALOTTED	TIME		REMARKS
			FROM	TO	

6. PROCEDURE:

1)
2)

3)
4)
5)
6)
7)
8)

WORK SHEET 3.1a

PROFILE LEVELLING

5. TABULATIONS &CALCULATIONS:

Station	Staff	Distance In meters	Staff Reading			Height of Instrument or		Reduced Level	Remarks
			Back (B.S)	Inter (I.S)	Fore (F.S)	Rise	Fall		
	1	0							
	L1	2							
	L2	4							
	R1	2							
	R2	4							

CHECK

(RESULT:_____

_____

8. DEFICIENCIES/MALFUNCTIONING OF ANY APPARATUS: _____

_____

_____

9. SCHEME OF EVALUATION

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	E. Fixing the tripod F. Setting up the dumpy level on tripod G. Holding the Levelling staff H. Placing the chain along route	10	

2.Manipulation of apparatus	F. Levelling using Tripod legs G. Levelling using foot screws H. Centering I. Adjusting the eyepiece J. Adjusting the focusing screw	15	
3.Precise Operation/Activity	E. Sigthing the levelling staff F. Observing the readings on levelling staff G. Noting down the readings in levelling field book H. Calculating RLs	20	
4. Values	F. Co-operation G. Co-ordination H. Communication I. Sharing J. Leadership	5	
Total		50	

Signature of the student **Signature of the staff member**

WORK SHEET 3.3.8 Profile Levelling by taking Longitudinal Section and Cross Section

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. **Objective of the experiment:** To conduct profile leveling for the given profile along LS and CS

2. **Apparatus/Tools required:** Dumpy level, plumb bob, pegs, leveling staff,chain/tape,string.

3. Rough Sketch:

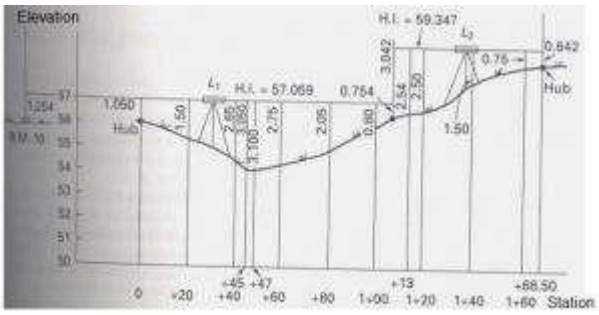
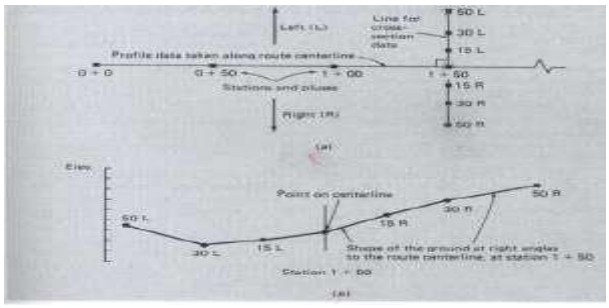


Figure 1: Profile leveling

longitudinal profile



cross sectional profile

4. Team members:

5. Distribution of Work:

S.no.	Name of the student	Work allotted/performed	Time

6. PROCEDURE:

1)mark centre line for the given profile
2) Fix the stations by fixed interval along the centre line
3) mark the points with fixed interval from both the sides of centre line from already marked stations on centreline with pegs
4) Dumpy level is mounted on tripod after centring
5)The temporary adjustments are carried out for the dumpy level.
6)The level is sighted to the benchmark and all the visible stations and the readings are noted.

7)The instrument station can be changed and take the staff readings for remaining stations
8)At each instrument station,BS,IS,HI and FS readings are noted.
9)The readings are tabulated and RLs are calculated for all the stations
10) The graph is plotted by using RLs for the stations marked along the centre line
11) This gives the longitudinal section profile
12)The cross sectional profiles are drawn for every cross section by using the RLs.
13)The cross section consists of main station located on centre line and the stations located across it both the sides
14)This gives the cross sectioinal proile at any station lies on centreline
15)Thus the topography of the profile is observed by using graphs

7. OBSERVATIONS/tabulations:

station	B.S	I.S	F.S	H.I	R.L	Remarks	
A							
B							
C							
D							
E							
F							
G							
Sum							

8. Remarks/comments:

9. **RESULT**:_____

_____

10. CERTIFICATION:

Signature of the student

Signature of the Lecturer

WORK SHEET 3.3.9 Block LEvelling

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the experiment: BLOCK LEVELLING FOR THE GIVEN AREA
2. Objective of the experiment: _____

_____

3. Apparatus/Tools required: _____

_____

4. Rough Sketch / Field Sketch:

5. Distribution of Work (If Given)

Sl.No	Name of the Student	Work Allotted / Performed	Time		When did he do
			From	To	
1					
2					
3					
4					
5					
6					

WORK SHEET 3.9 **Contouring by Block Levelling**

6. PROCEDURE: (Simple Sentences not exceeding 15 points)

1)
2)
3)
4)
5)
6)
7)

8)
9)
10)
11)
12)
13)
14)
15)

7. OBSERVATIONS AND TABULATIONS:

Station	B.S	I.S	F.S	H.I	R.L	Remarks
A						

WORK SHEET 3.9

Contouring by Block Levelling

SPECIMENS CALCULATIONS

Height of Instrument = Reduced level of Bench Mark + Back Sight

=

Reduced Level of a point = Height of Instrument – Intermediate Sight / Fore Sight

=

Arithmetical Check: $\sum BS - \sum FS = \text{Last RL} - \text{First RL}$

$\sum BS - \sum FS$ =

Last RL – First RL =

8. COMMENTS / REAMRKS:_____

_____

_____

_____

_____

9. SCHEME OF EVALUATION

Category of skill	**Sub Task**	**Weight with competency level individually**	**Awarded (50)**
1. Handling of apparatus/tools/ material	A. Fixing the Tripod B. Setting the level on tripod C. Levelling the instrument with tripod legs D. Holding the levelling staff	A 2 B 2 C 3 D 3 Total 10	

<table>
<tr><td>2.Manipulation of apparatus</td><td>A. Eliminating parallax error
B. Setting up the instrument at suitable position covering the entire area given
C. Dividing the area into uniform square blocks</td><td><table><tr><td>A</td><td>5</td></tr><tr><td>B</td><td>5</td></tr><tr><td>C</td><td>5</td></tr><tr><td>Total</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>3.Precise operation / activity</td><td>A. Adjusting foot screws for accurate leveling
B. Taking Back sight, Intermediate sight and Fore Sight readings
C. Noting down staff readings at respective columns in Field book
D. Calculating RL’s of every staff station
E. Plotting Contours of equal elevation</td><td><table><tr><td>A</td><td>2</td></tr><tr><td>B</td><td>5</td></tr><tr><td>C</td><td>3</td></tr><tr><td>D</td><td>5</td></tr><tr><td>E</td><td>5</td></tr><tr><td>Total</td><td>20</td></tr></table></td><td></td></tr>
<tr><td>4. Values</td><td>A. Co-operation
B. Co-ordination
C. Communication
D. Sharing
E. Leadership</td><td>5</td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

Signature of the Student **Signature of the Faculty Member**

WORK SHEET 3.3.10 Contouring by Radial Method

WORK SHEET

<table>
<tr><td colspan="2">Name of the student:</td><td rowspan="2">Date of experiment:</td></tr>
<tr><td>PIN:</td><td>Branch:</td></tr>
<tr><td colspan="2">Institution:</td><td>Experiment No:</td></tr>
</table>

1. Title of the experiment: Locating contour points by direct (radial) method in the field

2. Objective of the experiment: _____

_____

3. Apparatus/Tools required: _____

_____

4. Rough Sketch / Field Sketch:

5. Distribution of Work (If Given)

S.No	Name of the Student	Work Allotted / Performed	Time		When did he do
			From	To	
1					
2					
3					
4					
5					
6					

WORK SHEET 3.10 **Contouring by Radial method**

6. PROCEDURE: (Simple Sentences not exceeding 15 points)

1)
2)
3)

4)
5)
6)
7)
8)
9)
10)
11)
12)
13)
14)
15)

7. OBSERVATIONS AND TABULATIONS:

Station	B.S	I.S	F.S	H.I	R.L	Remarks
A						

WORK SHEET 3.10

Contouring by Radial method

SPECIMENS CALCULATIONS

Height of Instrument = Reduced level of Bench Mark + Back Sight

=

Reduced Level of a point = Height of Instrument – Intermediate Sight / Fore Sight

=

Arithmetical Check: $\sum BS - \sum FS = \text{Last RL} - \text{First RL}$

$\sum BS - \sum FS$ =

Last RL – First RL =

8. COMMENTS / REAMRKS:_____

_____

_____

_____

_____

WORK SHEET 3.10

Contouring by Radial method

9. SCHEME OF EVALUATION

Category of skill	Sub Task	Weight with competency level individually	Awarded (50)
1. Handling of apparatus	A. Centring B. Levelling C. Eliminating of parallax	A B C 5 3 2 (A+B+C=10)	
2.Manipulation Of apparatus	A. Bisecting the staff using telescope B. Observing the staff readings C. Recording the values D. Marking the points on the ground	A B C D 3 5 3 4 (A+B+C+D=15)	
3.Precise Operation/Activity	A. Calculating RLs B. Drawing the contours	A B 5 15 (A+B = 20)	
4. Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	Each carries one mark Total 5	
	Total	50	

Signature of the Student

Signature of the Faculty Member

EXPERIMENTAL METHODOLOGY 4.1.1 Folding and Unfolding a Chain

FOLDING AND UNFOLDING A CHAIN

A. THEORY

The objective of this experiment is to practice unfolding of chain before taking the linear measurement of a line using chain and folding the chain after completing chain survey work as it is to be practiced to handle chain easily and to maintain its links properly

B. PROCEDURE:

Unfolding:-

- Before taking measurements, the chain should be unfolded
- To unfold a chain, the strap is unfastened
- The chain is lifted into right hand, keeping brass handles in left hand of leader/follower. The chain should be thrown with right hand
- The follower stands at the starting station by holding one handle and leader moves forward by holding the other handle until the chain is completely opened
- Spread the chain correctly with throwing if necessary to clear any kinks or bents in links to make the chain straight.

Folding:-

- After the day's work is completed, the chain should be folded and fastened with a leather strap.
- To fold a chain, drag the chain with one handle and by pulling the chain at middle the two handles are to be brought to one end.
- Commencing from the middle of the chain two pairs of links are to be taken at a time with right hand and placed on left hand alternately in both directions and folding till the two brass handles will appear at top
- Then the bunch should be fastened with leather strip

E. INFERENCE

EXPERIMENTAL METHODOLOGY

PERFORM DIRECT RANGING

C. THEORY

The objective of this experiment is to Perform direct ranging on level ground and measure the distance between two given stations and record the measurements in the field book.

Ranging: It is the process of establishing, a number of intermediate points on a survey line joining two stations and it may be measured accurately.

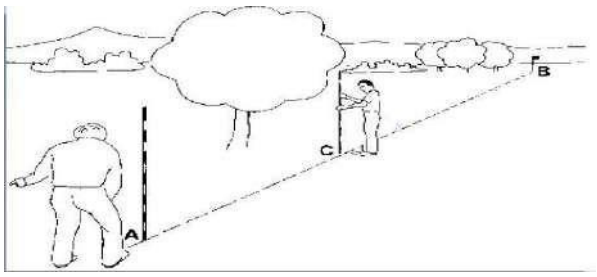
Ranging is two kinds:

1. Direct ranging and
2. Indirect ranging

Direct Ranging: When ranging rods are placed on the intermediate points along the chain line by direct observation from either ends of station, the process is known as direct ranging.

D. PROCEDURE:

- **Direct Ranging** :



Let A and B be two stations and C be the intermediate points to be established. The procedure for marking the intermediate points as described in procedure.

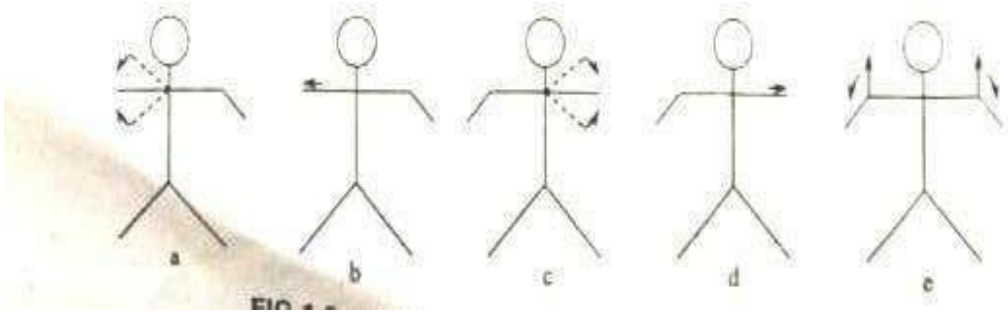
PROCEDURE:

1. Ranging rods are erected vertically behind each end of the line.
2. A survey or stands behind the ranging rods at the ends. A and B of the line
3. One of the surveyors, says the surveyor at A, directs the assistant to hold a ranging rod vertically at arm's length from the point where the intermediate point is to be established.

4. The assistant is directed to move the rod to the right or left until the two ranging rods appear to be exactly in a straight line. The code of signal used is started on Table. The signals given by the surveyor are shown in figure.
5. The surveyor at A then sits down and ensures that the bottom of all two ranging rods are in same line
6. The surveyor then signals the assistant to fix the rod.

CODE OF SIGNALS

S.No	Signal given by the surveyor	Meaning of the signal for the assistant
1	Rapid sweep with right hand (a)	Move considerably in that direction (to your left)
2	Slowly sweep with right hand	Move slowly to your left
3	Right arm extended (b)	Continue to move to your left
4	Right arm up and move to the right	Plumb the rod to your left
5	Rapid sweep with left hand (c)	Move considerably in the direction (to your right)
6	Slow sweep with left hand	Move slowly to your right
7	Left arm extended (d)	Continue to move your right
8	Left arm up and moved to the left	Plumb the to your right
9	Both hands above head and then brought down (e)	Ranging is correct
10	Both arms extended forward horizontally and the hands brought down quickly	Fix the ranging rod



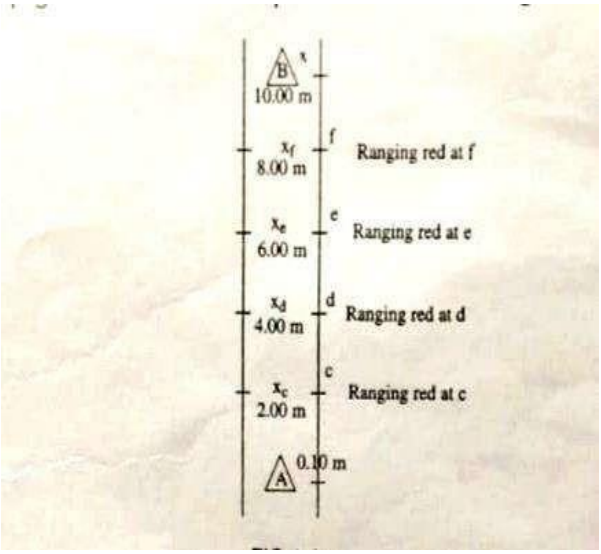
Pictorial Representation of signals

After the conformation with the eye that all the ranging rods are at the same line length AB may be measured with the chain or tape. Check the length of AB with the steel tape and if the dimensions are same take it as distance between A and B. If there is measurement better chain and steel tape are not same repeat the procedure once again and ascertain two correct lengths. Even an repetitions the length both by chain and steel tape are not talled, it can be understood that there is error is length of chain and the chain and it has to be corrected as per procedure with reference permanent length marked to all or plinth line of the survey lab building.

FIELD NOTE BOOK:

This is a book in which the field measurements and relevant notes in the field are recorded. It is about 200 × 120 mm in size and opens lengthwise. Each page is ruled with single line or central column 15 mm wide running up long length of the page. The pages of the field books are machine numbered.

For example: Field book



E. INFERENCE

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PERFORM INDIRECT RANGING AND MEASURE THE DISTANCE BETWEEN TWO GIVEN STATIONS WHEN A HIGH GROUND INTERVENES TO PREVENT INTERVISIBILITY OF ENDS OF LINE

A. THEORY

RANGING

The process of fixing or establishing intermediate points when the length of survey line to be measured exceeds the chain is known as Ranging.

INDIRECT RANGING

When both ends of the survey line are not indivisible due to high intervening ground, the method resorted for ranging is known as indirect ranging.

B. PROCEDURE

1. Fix the two ranging rods at the given stations A and B which are not indivisible due to high intervening ground.
2. Select two intermediate points M1 and N1 very near to chain line in such a way that from M1 both N1 and B are visible and from N1 both M1 and A are visible
3. The Surveyor at M1 directs the person at N1 to move to a new position N2 in line with M1B.
4. The Surveyor at N2 then directs the person at M1 to move to a new position M2 in line with N2 A.
5. The Surveyor at M2 directs the person at N2 to a new position N3 in line with M2 B.
6. The Surveyor at N3 directs the person at M2 to a new position M3 in line with N3A.
7. The process is repeated till the points M and N are located in such a way that the Surveyor atM finds the Surveyor at N in line with MB and the Surveyor at N finds the Surveyor at M in line with NA.
8. After fixing the points M and N, other points are also fixed by direct ranging.
9. Measure the distance with the help ofchain.

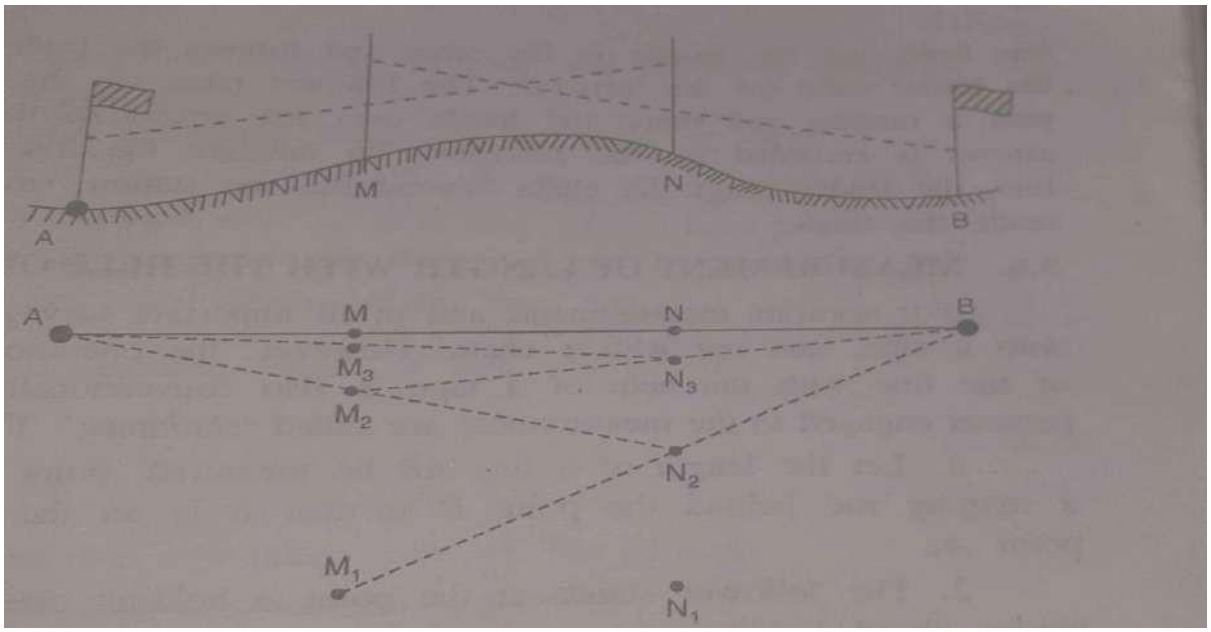

FIG. INDIRECT RANGING

C.RESULT

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SET OUT A RIGHT ANGLE TO A GIVEN CHAIN LINE BY USING CHAIN ONLY

A. THEORY

In survey work, it is often necessary to set out right angles or perpendicular lines to the given chain line by using chain only without any instruments. Geometrical constructions are used in this method. The 3-4-5 method is one of the methods commonly used. This method is based on Pythagoras Theory. Pythagorean Triplets other than 3, 4&5 can also use in this method.

B. PROCEDURE

1. Set a survey line A B on the ground.
2. Select a point C, at which it is required to set out a right angle on the survey line AB and place peg.
3. Calculate perimeter of triangle formed by Pythagorean Triplets.
4. For the taken 3-4-5 triplets the perimeter is 12m
5. Establish a point E at a distance of 3m from C and place peg.
6. The first person holds the 0 end of the chain together with 12 m link of the chain at C
7. The second person holds the 3 m link at E on the base line/survey line AB.
8. The third person holds the 8 m link andstretchesthe chain and places a peg at point D.
9. The angle between the line connecting peg C and peg D and E is a right angle

C. SKETCH

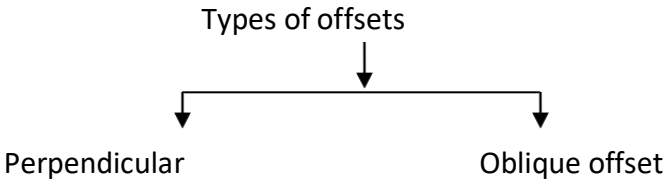
EXPERIMENTAL METHODOLOGY 4.1.5 Setting Perpendicular and Oblique Offsets to Chain line and Measuring them

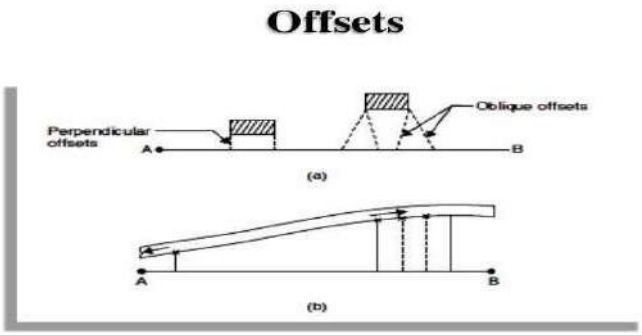
EXPERIMENTAL METHODOLOGY

Setting Perpendicular and Oblique Offsets to Chain line and Measuring them

E. THEORY

OFFSETS: The lateral measurements taken from an object to the line is known as offset. Offsets are taken to locate adjacent objects with reference to the chain line. They only are two kinds.

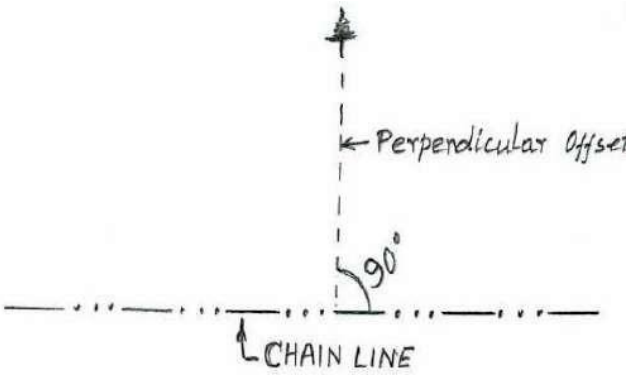




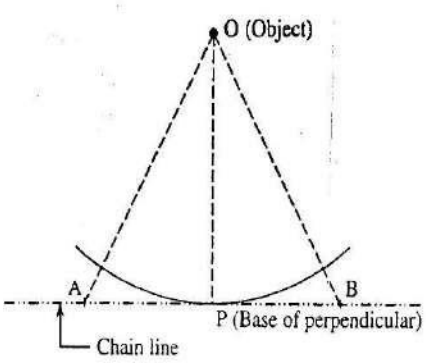
F. PROCEDURE:

1. PERPENDICULAR OFFSETS:

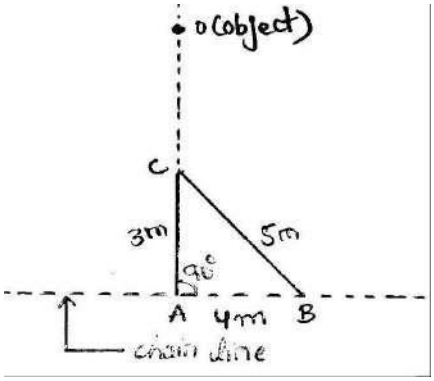
a. When the lateral measurements are taken perpendicular to the chain line, they are known as perpendicular offsets.



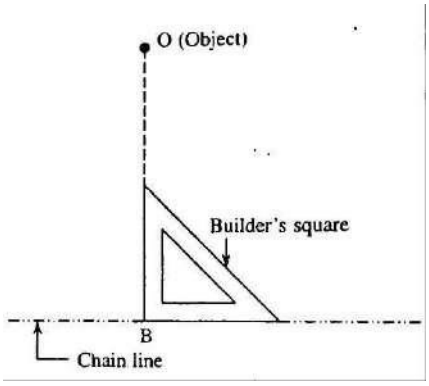
b. By setting a perpendicular by swinging a tape from the object to the chain line. The point of minimum reading on the tape will be the base of the perpendicular.



c. By setting a right angle in the ratio 3:4:5.



d. By setting a right angle with the help of builder's square or a trisquare. By setting a right angle by cross-staff.

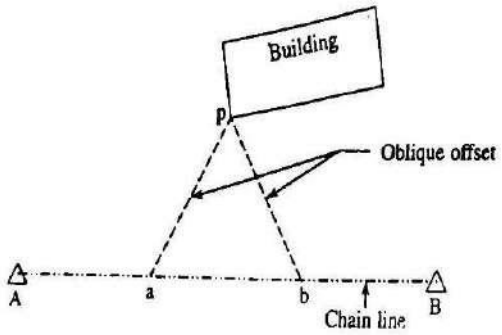


2. OBLIQUE OFFSETS:

Any offset not perpendicular to the chain line is said to be oblique.
Oblique offsets are taken when the objects are at a long distance from the

chain line or when it is not possible to set up a right angle due to some difficulties. Such offsets are taken in the following manner.

Suppose AB is a chain line and B is the corner of the building. Two points ‘a' and ‘b' are taken on the chain line. The chainages of a and b are noted, the distance ‘ap' and ‘bp' are measured and noted in the field book, then ‘ap' and ‘bp' are the oblique offsets. When the triangle abp is isolated, the apex point p will represent the position of the corner of the building.



Perpendicular offsets are preferred for the following reasons,

a. They can be taken very quickly.
b. The progress of survey is not hampered.
c. The entry in the field book becomes easy.
d. The plotting of the offsets also becomes easy.

3. NUMBER OF OFFSETS:

The offsets should be taken according to the nature of the objects. So, there is no hard and fast rule regarding the number of offsets. It should be remembered that the objects are to be correctly represented and hence the number of offsets should be decided on the field.

4. LIMITING LENGTH OF OFFSET:

The maximum length of the offset should not be more than the length of the tape used in the survey. Generally, the maximum length of offset is limited to 15m. However, this length also depends upon the following factors.

a. The desired accuracy of the map.
b. The scale of the map.
c. The maximum allowable deflection of the offset from its true direction

and

d. The nature of the ground.

OBSERVATION AND CALUCULATION:

S.No offset	Types of object to chainage	Length from 1st trail	Length of Offset		
			2nd trail	3rd trail	Average
I.1.	Perpendicular	O.P=	m	m	m
2	Perpendicular	O.A=	m	m	m
3	Perpendicular	O.B=	m	m	m
II.1.	Oblique offset	ap=	m	m	m
2	Oblique offset	bp=	m	m	m

RESULT:

Setting of perpendicular and oblique offsets.

E. INFERENCE

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EXPERIMENTAL METHODOLOGY 4.1.6 TRIANGULATION SURVEY OF A GIVEN AREA WITH CHAIN AND CROSS STAFF

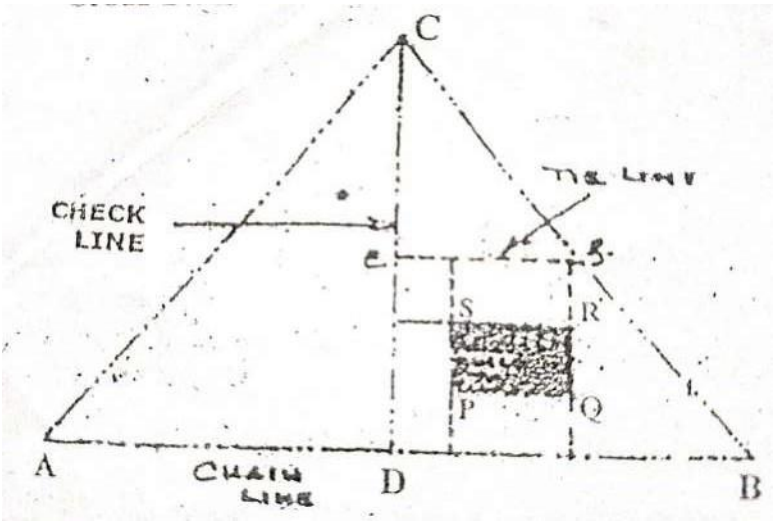
EXPERIMENTAL METHODOLOGY

TRIANGULATION SURVEY OF A GIVEN AREA WITH CHAIN AND CROSS STAFF

G. THEORY

The principle of chain surveying is triangulation. This means that the area to be surveyed is divided into a number of small triangles which should be well conditioned. In chain surveying the sides of the triangles which should be well conditioned. In chain surveying the sides of the triangles are measured directly on the field by chain or tape, and no angular measurements are taken. Here, the tie lines and check lines control the accuracy of work.

H. PROCEDURE:



1. Select three survey station A, B and C such that from each survey station the other two station are visible.

2. Fix the ranging rods at A,B and C

3. Fix the intermediate points D e f

4. Measure the offsets of the corner of the building either perpendicular or oblique

5. Each point requires two measurements from two definite reference points on the chain line from two adjacent chain lines.

6. Measure the points which are far away from the main chain lines from tie line from tie lines i.e., the corner points of building R and S. Measure the check line CD

Result: From the recorded measurements of the building area is plotted

NOTE: The students are required to maintain separate chain field note book to enter the field measurements.

RESULT:

Area of the building from the plotting:

E. INFERENCE

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EXPERIMENTAL METHODOLOGY 4.1.7 Calculate The Area By Chain Triangulation

CALCULATE THE AREA BOUNDED BY THE GIVEN POINTS BY CHAIN TRIANGULATION

A. THEORY

It is method of surveying is used to locate boundaries of a field and to determine its area. It is method of surveying in which the area to be divided into a number of triangles .The length of the sides are measured and the interior details are recorded. The whole area is then plotted on a drawing sheet to a suitable scale to prepare a map. To a small area into number of triangles, measure the distance 0f various objects in the field from the line and record in the field book from which the area can be plotted on a drawing sheet to a suitable scale.

B. PROCEDURE

1. Select three survey stations A,B and C such that from each survey station the other two statiohs are visible.
2. Fix the ranging rods at A,B,C,D and E
3. Fix the intermediate stations along the chain line AB,BC and CA by ranging
4. A Chain line is run through the center of area which divided into a no. of Triangles.
5. After the field work is over the survey is plotted to a suitable scale
6. Then the area of a field is calculated.
7. Draw a complete figure in field book using field observation.

C. OBSERVATIONS AND TABULATIONS

Area of Triangle $=\sqrt{\{ S(S-a)(S-b)(S-c) \}}$

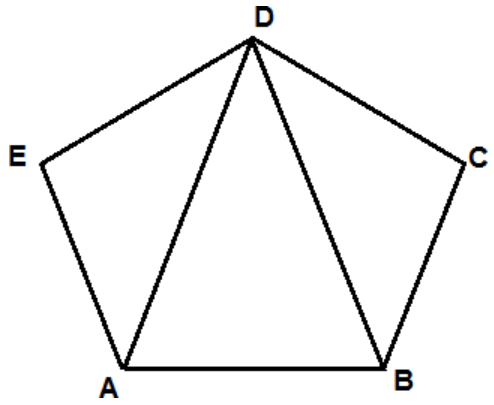
$S=(a+b+c)/2$

Where,

a,b,c are the sides of the triangle

S.NO.	Figure	Length(m) (a)	width(m) (b)	height(m) (c)	perimeter(m) S=(a+b+c}/2	Area(M2)	Remarks
1							

2							
3							
4							
5							
6							
7							



Prepared by Y.Sankara Rao,

L/CE,GMR Polytechnic,Paderu

CALCULATION OF THE AREA BOUNDED BY THE GIVEN POINTS BY CHAIN AND CROSS STAFF

A. THEORY

Cross staff survey is used to locate boundaries of a field or Plot and to determine its area. Chain is used for measuring distance along the chain line and a tape for measuring the offsets. The cross staff is used to set out the perpendicular directions for offsets. In this survey, the base line runs through the center of the area, so that the offsets are left or right side of base line are fairly equal. To check accuracy length of the boundary lines may also be measured. After the field work is over, the survey is plotted to a suitable scale. By this method of survey, the field as divided in to right angled triangles and trapezoids are calculated as under:

1)Area of right -angled triangle = ½ base x Height.

2)Area of trapezoid= sum of parallel sides/2 x Height.

Add the areas of all the triangles & trapezoids and sum is equal to the total of a field. The computations for area should be written in a tabular form.

B. PROCEDURE

1. This Survey is carried out to locate the boundaries of a field
2. Fix the ranging rods at boundaries of a survey line
3. The offsets to the boundary are taken in order to their chainages as shown.
3. A Chain line is run through the center of area which divided into a no. of Triangles and Trapezoids
4. After the field work is over the survey is plotted to a suitable scale
5. Then the area of a field is calculated as shown in tabular column.
6. Draw a complete figure in field book using field observation

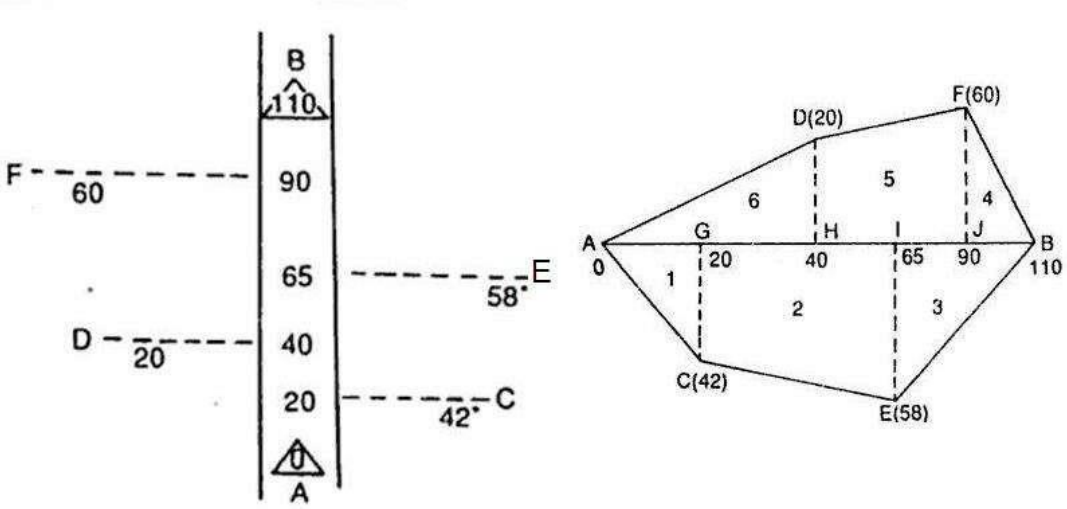
C. OBSERVATIONS AND TABULATIONS

Area of boundary = Sq.m

S.NO.	Figure	Chainage(m)	Base(m)	Offset(m)	Mean(m)	Area(Sq.m)	Remarks

1							
2							
3							
4							
5							
6							
7							

FIGURE



D. CALCULATIONS:

Prepared by Y.Sankara Rao, L/CE,GMR Polytechnic,Paderu

CARRYING OUT CHAIN SURVEY TO OVERCOME OBSTACLES

I. THEORY

The objects, which create obstructions or difficulty in continuing the chaining of a survey line, are called obstacles. The cases of obstacles

1. Chaining is obstructed, but vision is free. Example: a pond or river obstructing the chaining
2. Chaining is free, but vision is obstructed. Example: A thick wooded forest obstructing the chaining
3. Chaining and vision both are obstructed. Example: A building obstructing the chaining

J. PROCEDURE:

I. Case I: Chaining is obstructed, but vision is free:

Let AB be the chain line. Measure the length of obstructing part between A and B to continue chaining

a) When pond is obstructing the chaining

Method-I

1. Select two points C and D on either side of pond and along chain line AB.
2. Erect perpendicular CE at C and join E and D.
3. Measure CE and ED. Now CDE is a right-angled triangle.

$$CD = \sqrt{ED^2 - CE^2}$$

Method-II

1. Select two points P and Q on either side of pond and along chain line AB.
2. Erect equal perpendiculars PR and QS (so that PR=RS) at P and Q. Now the distance RS is measured. Then PQ=RS.

b) When river is obstructing the chaining

1. Select two points P and Q on opposite banks of river and along chain line AB.
2. Erect perpendicular PR at P and bisect PR at T
3. Erect another perpendicular at R and select S on it so that Q, T and S are on the same line. From similar triangles PQT and TRS PQ=RS

II. Case II: Chaining is free, but vision is obstructed:

Perform Experiment No.1.3

III. Case III: Chaining and vision both are obstructed.

Let AB be the chain line and a building is obstructing AB. Establish the intermediate points on AB to measure the length of obstructing part to continue chain line AB using the following procedure.

1. Select two points P and Q on chain line AB on one side of the building
2. Erect equal perpendiculars PP1 and QQ1 at P and Q respectively.
3. Join P1 and Q1 and extend the line P1Q1 until the building is crossed.
4. Select two points R1 and S1 on the extended line so that the points crossed the building.
5. Erect equal perpendiculars R1R and S1S so that PP1 = R1R =S1S= QQ1 at S and R respectively.
6. As the points P, Q, R and S lie on same line AB, the required length of obstruction QR is obtained by measuring the length Q1R1

A. OBSERVATIONS AND CALCULATIONS

Case I:

a) Method-I

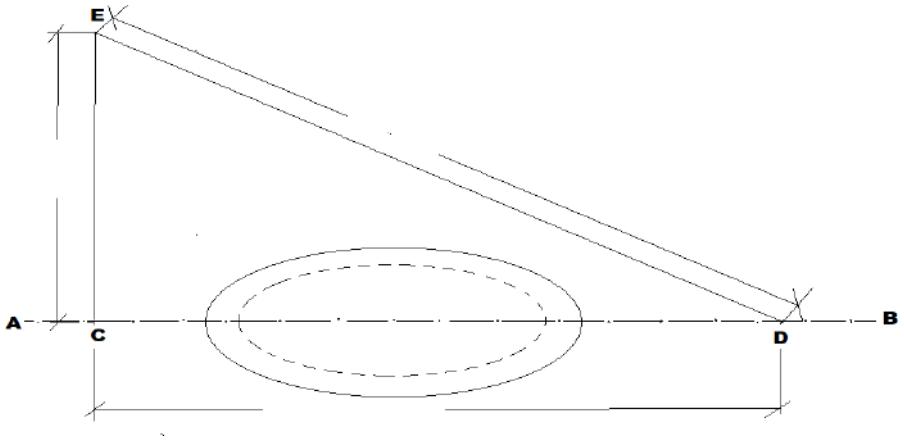


Fig. 1

CE=
ED=

$$CD = \sqrt{ED^2 - CE^2} =$$

Method-II

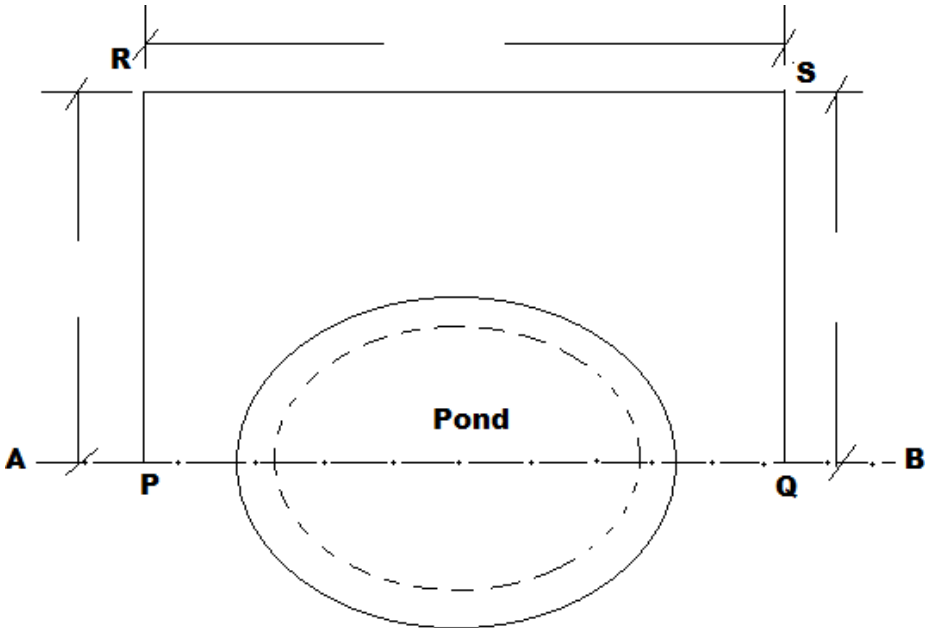


Fig. 2

Measure i) PR= QS=
ii) Length of obstructing part RS=

b)

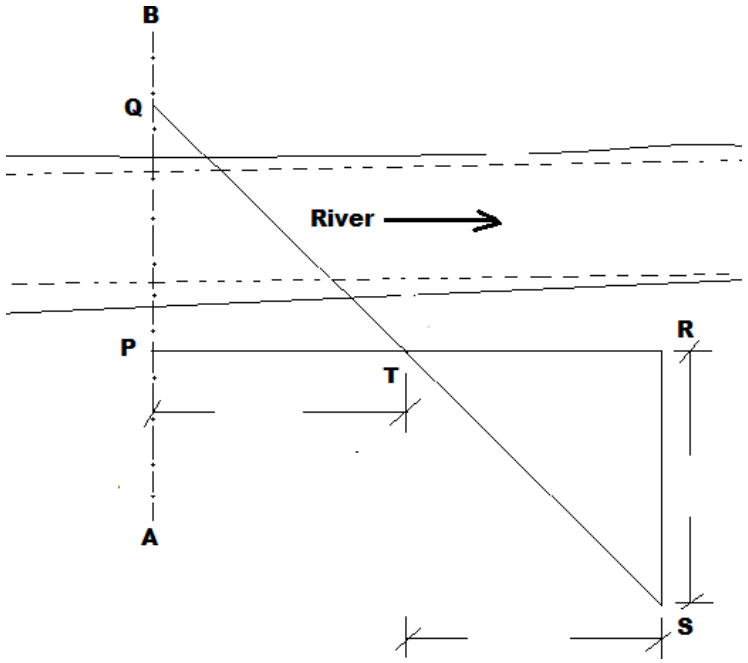


Fig.3

Measure i) PT = TR =

ii) Length of obstructing part PQ = RS=

Case III :

Measure i) PP1 = QQ1 = RR1=SS1

ii) Length of obstructing part QR = Q1R1 =

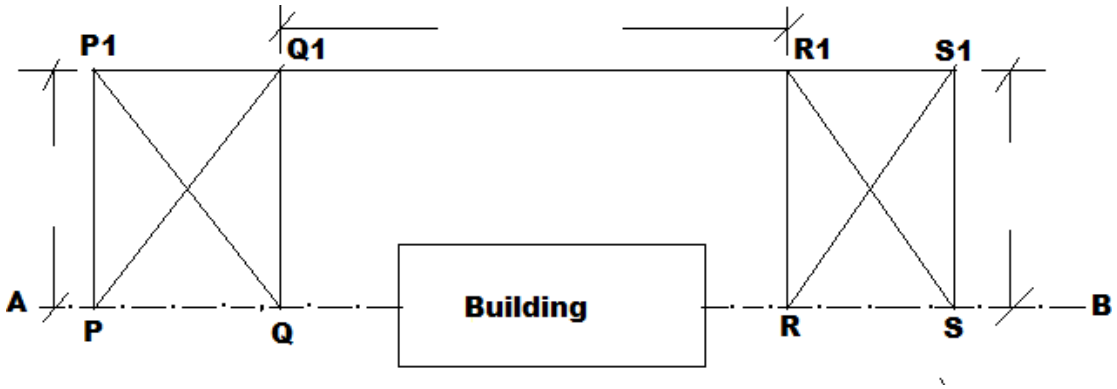


Fig.4

K. PLOTTING

Case – I a. Method-I

- **Select a suitable scale**
- **Draw a horizontal line of any length.**
- **Select a point C on it.**
- **Draw perpendicular line CE at C.**
- **Draw an arc of length ED from E so that it intersects the line CD at D. Measure the line CD. And make scale conversion. The final length of CD after scale conversion is the required length of obstruction.**

E. INFERENCE

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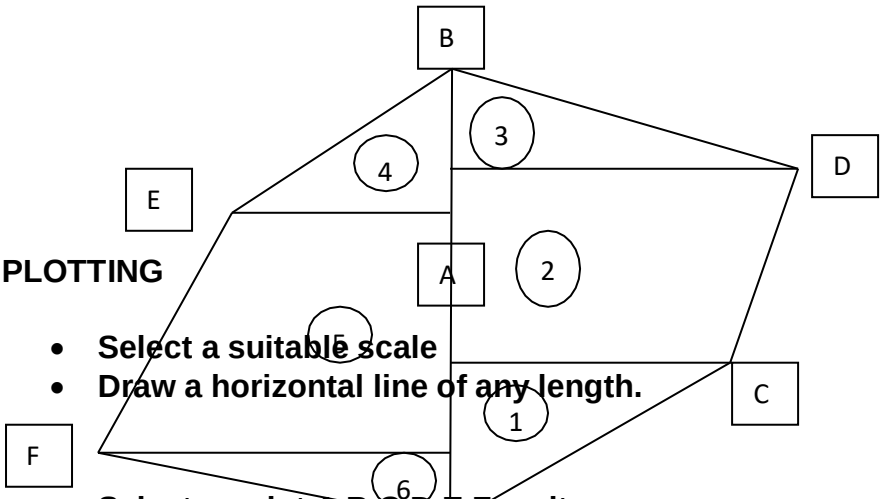
CARRYING OUT CHAIN TRAVERSING TO SURVEY AN AREA BOUNDED BY MORE THAN THREE STAIONS

L. THEORY

This survey is carried out to locate the boundaries of a field and to determine its area and to plot the same in the field book

M. PROCEDURE:

1. This survey is carried out to locate the boundaries of a field and to determine its area.
2. A chain line is run through the center of area which divided into a no. of Triangles and trapezoids.
3. The offsets to the boundary are taken in order to their chainages as shown.
4. After the field work is over the survey is plotted to a suitable scale.
5. Then the area of a field is calculated



N. PLOTTING

- **Select a suitable scale**
- **Draw a horizontal line of any length.**
- **Select a point A,B,C,D,E,F on it.**
- **Draw perpendicular lines on AB line from C,D,E and F.**
- **Measure the areas of the individual area and sum it up.**

E.INFERENCE

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Identifying the Parts & Temporary Adjustments of Prismatic Compass

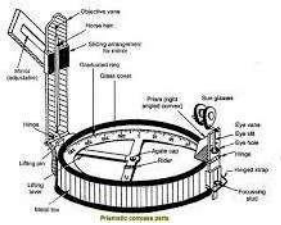
A. THEORY

A Prismatic Compass is an instrument used to measure the bearings of a traverse line with respect to Magnetic North. The horizontal angle made by a survey line with reference to magnetic meridian in clock-wise direction is called the 'bearing' of a line. The compass is usually mounted on a tripod which is having a vertical spindle in the ball and socket arrangement to which the compass is screwed

B. PROCEDURE

1. **Set up** the **Tripod**at station 'A' and push its legs firmly into the ground
2. Mount the compass on the Tripod and **Centre** it over the Station using a **Plumb bob**/dropping a stone from bottom of the compass box
3. **Level** the instrument so that the **graduated circle** swings freely in the box
4. Unfold the **object vane**and **eye vane**of the instrument
5. **Focus** the prism by sliding with Focus stud till the graduations are clearly visible
6. Mark the object on which the **bearing** is to be taken
7. **Sight** the objectby rotating the compass looking through the eye slit lineup with the **horse hair** in the objectvane or till it bisects the object
8. **Measure** the bearing on the graduated ring attached to magnetic needle

a) Prismati compass b) Tripod



c)Prismatic compass schematic diagram (courtesy: Internet)

B. OBSERVATIONS AND TABULATIONS

S.no	Station	Line	W.C.B
1.	A	AB	$30°0'$
2		AC	$54°30'$
3		AD	$60°30'$
4	B	BA	$210°0'$

5		BE	95°30′

EXPERIMENTAL METHODOLOGY 4. 1a **Setting up the compass and observation of bearing**

C.SPECIMEN CALCULATIONS:

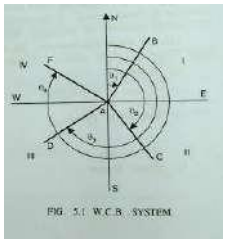
W.C.B of the line $AB = 30° \, 0'$

$$\therefore R.B = N \; 30° \; 0' \; E$$

W.C.B of the line $BE = 95° \, 30'$

$$\therefore R.B = 180° - 95° \, 30'$$
$$= S \; 84° \; 30' \; E$$

D.SCHEMATIC DIAGRAM



Magnetic bearing at a station

D.RESULT

E.INFERENCE

_____

_____

_____

_____

TAKING BEARINGS OF TWO POINTS FROM INSTRUMENT - STATION AND CALCULATE THE INCLUDED ANGLE

A. THEORY

Compass is a circular box of diameter 85 to 110 mm having pivot at the center and covered with plain glass at top.It is fitted with magnetic needle which facilitates in taking the bearings of survey lines with reference to the magnetic north. A graduated ring is housed in the box where the bearings are marked inverted from 0^0 to 360^0 in clockwise direction.Prism ,object vane,brake pin,lifting pin etc are the other important components in the compass.

Bearing of a line is its direction relative to a given meridian.A bearing may be either whole circles bearing or quadrantal bearing. A meridian is any direction such as True meridian, Magnetic meridian and Arbitrary meridian

Included angle between any two successive survey lines can be measured using Prismatic Compass. The angle subtended by two survey lines at a point is known as included angle.

B. PROCEDURE

1. Let the P, O and Q are the three points on the ground as shown in fig
2. Set up the Compass at station O and perform all the temporary adjustments
3. Fix the ranging rods at the points P and Q
4. Sight the point P through prism vane and object vane
5. Observe the bearing through the prism and enter the reading in the field book
6. Now,sight the point Q through prism vane and object vane
7. Observe the bearing and note down in the field book
8. The difference of these two bearings is the included angle between OP and OQ

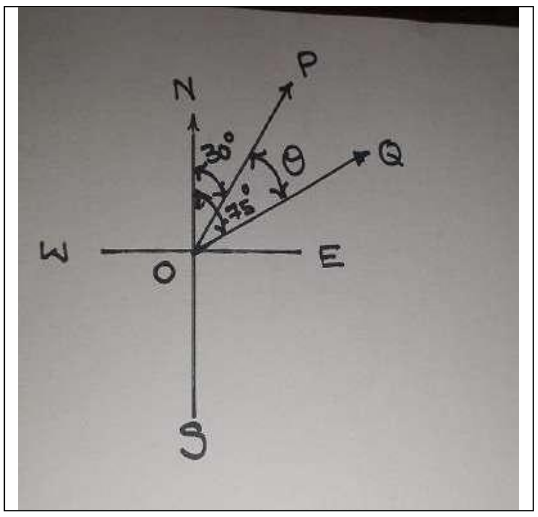


Fig.

C. OBSERVATIONS AND TABULATIONS

S.No	Instrument at	Sight to	Bearing	Remarks
1	O	P	$30^0 00'$	
		Q	$75^0 00'$	

D.SPECIMEN CALCULATIONS

Bearing of line OP= 30^0 00'
Bearing of line OQ = 75^0 00'
Include angle between the lines OP and OQ = Bearing of OQ- Bearing of OP

75^0 00'-$30^0$00' =$45^0$00'

E. INFERENCE

_____

_____

_____

_____

EXPERIMENTAL METHODOLOGY 4.2.4 Open Traverse using Compass

PERFORM AN OPEN TRAVERSE FORMED BY SERIES OF CONNECTED STRAIGHT LINES WITH COMPASS AND CHAIN.

A. THEORY

Compass is a circular box of diameter 85 to 110 mm having pivot at the center and covered with plain glass at top. It is fitted with magnetic needle which facilitates in taking the bearings of survey lines with reference to the magnetic north. A graduated ring is housed in the box where the bearings are marked inverted from 0^0 to 360^0 in clockwise direction. Prism, object vane, brake pin, lifting pin etc are the other important components in the compass.

Bearing of a line is its direction relative to a given meridian. A bearing may be either whole circles bearing or quadrantal bearing. A meridian is any direction such as True meridian, Magnetic meridian and Arbitrary meridian

The Bearing between any two successive survey lines can be measured using Prismatic Compass. The Bearing subtended by North to survey lines at a point is known as Fore. Bearing or Back, Bearing

B. PROCEDURE:

9. Setting the instrument at the starting station ‘A’ and perform all the necessary adjustments
10. . Sighting the next station ‘B’, taking fore bearing of ‘AB’ and measuring the distance ‘AB’
11. Taking F.B of CE, etc. also provides the check. ‘AE which provides check; similarly bearing of any line AC,
12. Shifting the instrument to subsequent station ‘B’. After fixing the instrument sight the previous station ‘A’ and observe the reading, which gives the B.B. of AB
13. Sighting next station ‘C’ observe F.B of BC and measure the distance BC.
14. Locating the details surrounding the traverse station if necessary, by taking bearings or lengths or both from chains line.
15. Repeating the same process at every station
16. It is to be noted that first and last stations have only fore bearing and back bearings respectively.
17. Taking back bearings of the first point from the succeeded point
18. Observing the bearing and note down in the field book. Entering the readings in a tabular form.

B.FIELD SKETCH:

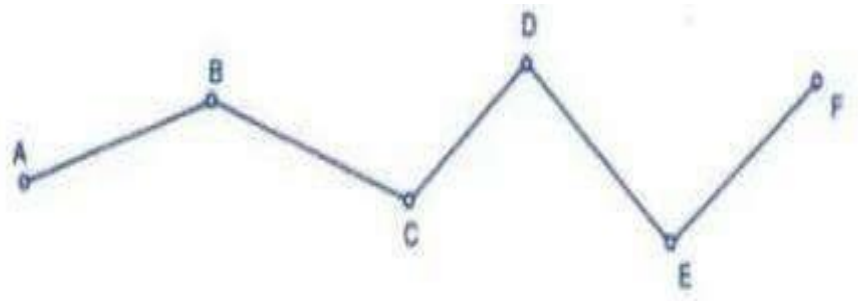


Fig 1: Open Traverse

C. OBSERVATIONS AND TABULATIONS

SL.NO.	LINE	LENGTH	F,B	B.B	Remarks
1	AB	25 m	$75^0\ 30^1$	$255^0\ 30^1$	STARTING POINT
2	BC	37 m	$110^0\ 00^1$	$290^0\ 00^1$	
3	CD	15 m	$47^0\ 30^1$	$226^0\ 30^1$	
4	DE	45 m	$295^0\ 30^1$	$114^0\ 30^1$	
5	EF	37 m	25^000^1	--	END POINT

CHECK: The difference between Fore bearing and back bearing of each line should be 180º, if no local attraction exists at either station.

D.SPECIMEN CALCULATIONS

(Reading no 1**)**

Fore Bearing of line AB= 75^0 30'

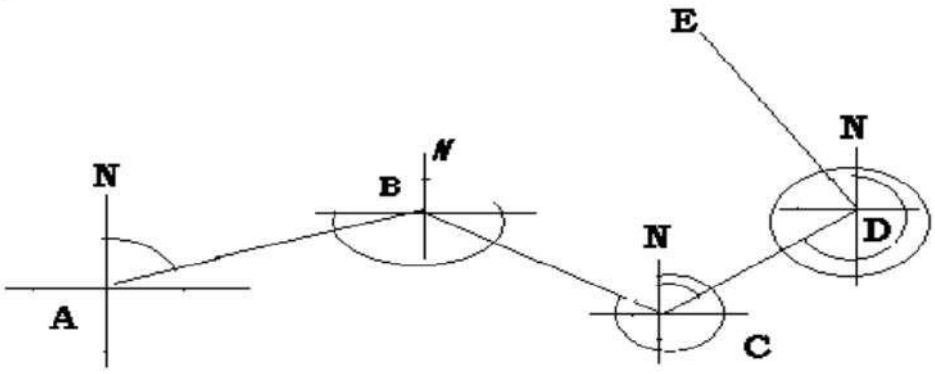
Back Bearing of line BA = 255^0 30'

Difference between the bearings of lines AB and BA = 180^0

E. PLOTTING:

1. Use the observations recorded in the table to draw the traverse on a drawing sheet.
2. Draw a line up the drawing sheet to represent the reference direction of the magnetic meridian and mark the starting point A.
3. Place the circular protractor with its centre at A and zero lined up with the reference direction. Mark on the paper against the protractor edge the corrected bearing of lineA B.
4. Remove the protractor, draw the direction of the line AB, scale the distance and plot the position of B.
5. Plot the direction of BC is by placing the centre of the protractor at B and orienting it By rotating it until its zero direction is parallel to the reference direction as before. This is achieved when the line BA cuts the protractor at the corrected bearing of BA.
6. Mark the bearing BC and plot C in the same way as B was plotted before.
7. Continue the process for all remaining stations. And thus obtain the figure ABCDE of open traverse.

SKETCH:

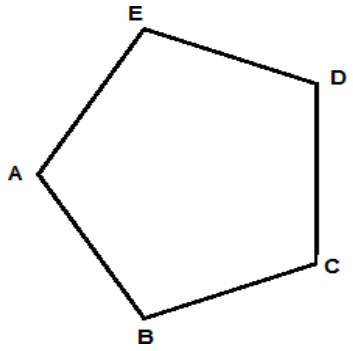


E.INFERENCE

EXPERIMENTAL METHODOLOGY 4.2.5 Closed traverse with Prismatic Compass and Chain

Closed traverse with Prismatic Compass and Chain

A. PROCEDURE:



1. **Fix** the traverse stations for the closed traverse**ABCDE**.
2. **Set** the compass at station 'A'.
3. **Perform** the temporary adjustments.
4. **Sight** the object at B and **note down** the FB of line AB and **measuring** the distance.
5. **Sight** the object at E and **note down** the BB of line EA.
6. **Locate** the details by observing bearings or lengths or both from the traverse stations wherever necessary.
7. **Sight** the instrument to station B, **performing** all the temporary adjustments.
8. **Shift** the object at A and **take** the BB of AB.
9. **Take** FB of BC and **measure** the length of BC.
10. **Check** whether the difference of FB and BB is 180^0 or not at all the stations.
11. **Continue** the same process at all other stations.
12. **Correct** the observed bearings for local attraction if any
13. **Calculate** the included angles of the traverse and check them
14. **Plot** the Traverse on a drawing sheet using the measurements
15. **Find** the area of the traverse.

B. OBSERVATIONS AND TABULATIONS:

Line	Length (m)	Fore Bearing	Back Bearing	Difference
AB	122.4	$70^0$30'	$250^0$30'	$180^0$00'

BC	98.6	$347^0 30'$	$167^0 30'$	$180^0 00'$
CD	65.2	$298^0 30'$	$118^0 30'$	$180^0 00'$
DE	136.8	$229^{00} 0'$	$49^0 30'$	$180^0 00'$
EA	220.4	$136^0 30'$	$316^0 30'$	$180^0 00'$

C.SPECIMEN CALCULATIONS:

Included angle = **Angle** 'A' = BB of EA - FB of AB =$316^0 30'$ - $70^0 30'$ = $246^0 00'$ (Ext)

= $360^0 00'$ - $246^0 30$ = $114^0 00'$ (Interior).

Apply same procedure to calculating the included angles.

Check = Sum of included angles = (2n – 4) x 90 =

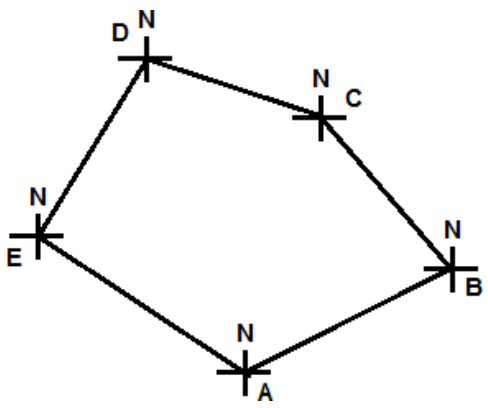
D.RESULT:

∠A = $114^0 00'$∠B = ∠C = ∠D = ∠E =

Area of the closed Traverse = Sq.m

E. PLOTTING:

1. Use the observations recorded in the table to draw the traverse on a drawing sheet.
2. Draw a line up the drawing sheet to represent the reference direction of the magnetic meridian and mark the starting point A.
3. Place the circular protractor with its centre at A and zero lined up with the reference direction. Mark on the paper against the protractor edge the corrected bearing of lineAB.
4. Remove the protractor, draw the direction of the line AB, scale the distance and plot the position of B.
5. Plot the direction of BC is by placing the centre of the protractor at B and orienting it by rotating it until its zero direction is parallel to the reference direction as before. This isachieved when the line BA cuts the protractor at the corrected bearing of BA.
6. Mark the bearing BC and plot C in the same way as B was plotted before.
7. Continue the process for all remaining stations. And thus obtain the figure ABCDEA.

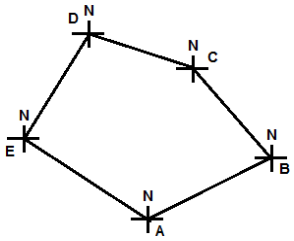


F.INFERENCE:

EXPERIMENTAL METHODOLOGY 4.2.6 Plotting the closed traverse and Adjusting for closing error by Bowditch rule

Plotting the closed traverse from field data and adjusting for closing error by Bowditch rule

C. PROCEDURE:



1. **Use** the observations recorded in the table to draw the traverse on a drawing sheet.
2. **Draw** a line up the drawing sheet to represent the reference direction of the magneticmeridian and **mark** the starting point A.
3. **Place** the circular protractor with its centre at A and zero lined up with the referencedirection. **Mark** on the paper against the protractor edge the corrected bearing of line AB.
4. **Remove** the protractor, **draw** the direction of the line AB, **scale** the distance and **plot** theposition of B.
5. **Plot** the direction of BC is by **placing** the centre of the protractor at B and **orienting** it by rotating it until its zero direction is parallel to the reference direction as before. This isachieved when the line BA cuts the protractor at the corrected bearing of BA.
6. **Mark** the bearing BC and **plot** C in the same way as B was plotted before.
7. **Continue** the process for all remaining stations. And thus**obtain** the figure ABCDEA'.
8. The figure ABCDEA' as now plotted does not truly represent the actual figure on the ground because the plotted figure gives two positions for A, where as only on exist on the ground.
9. This apparent displacement of A is due to the build-up of error in surveying and plotting around the traverse.

10. The total error in the figure indicated by the line AA' may be distributed back around the figure graphically in the following way called Bowditch's method:

a) A' should be at a and must be moved the distance AA' in the direction shown. The effect of this movement will be to move the plotted position of the other points proportionally along the parallel directions.

b) **Draw** lines **parallel to the direction** of the closing error through the other plotted points.

c) **Draw** a straight line and scale off the lengths of the traverse legs along it. The **scale** of this construction **need not be the same as for the original traverse plot** and is more conveniently drawn to a smaller scale.

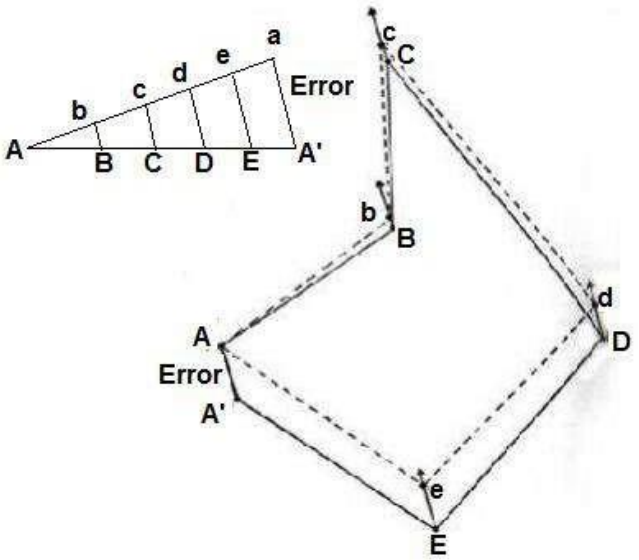
d) **Erect** perpendiculars at each point along the line. **Pick** off the length of the closing error on the plot with a pair of dividers and mark it on the perpendicular erected at A'. Join aA

e) The intersection of aA with the perpendiculars indicates the extent of adjustment needed for each station, illustrating also the proportional build-up or error from nothing at A to the maximum amount of A'.

f) The amount of error at E, being eE, is picked off the diagram and transferred to the line drawn through E on the plot parallel to the closing error, giving the adjusted position e. The other errors at each station are transferred to the plot in the same way.

g) Join up the positions of the adjusted points giving the figure AbcdeA, which now forms the graphically adjusted traverse.

This figure represents more closely the actual layout on the ground than the original plot did prior to adjustment.



D. OBSERVATIONS AND TABULATIONS:

Line	Length	Fore Bearing	Back Bearing	Difference

	(m)			
AB	122.4	$70^0 30'$	$250^0 30'$	$180^0 00'$
BC	98.6	$347^0 30'$	$167^0 30'$	$180^0 00'$
CD	65.2	$298^0 30'$	$118^0 30'$	$180^0 00'$
DE	136.8	$229^{00} 0'$	$49^0 30'$	$180^0 00'$
EA	220.4	$136^0 30'$	$316^0 30'$	$180^0 00'$

C.SPECIMEN CALCULATIONS:

Included angle == BB of AB - FB of AB =$250^0 30' - 70^0 30' = 180^0 00'$

D.RESULT:

Length of closing error = m

F.INFERENCE: _____

_____

_____

_____

EXPERIMENTAL METHODOLOGY 4.2.7 Method Of Radiation By Prismatic Compass And Chain

METHOD OF RADIATION BY PRISMATIC COMPASS AND CHAIN

A) PROCEDURE:

1) Establish given points in the field (A,B,C,D & E) with ranging rods.

2) Set the compass at station "O" (suitably at the center of area bounded by given points)

3) Perform the temporary adjustments of compass.

4) Use compass for bisecting ranging rod 'A' and note down bearing of line "OA"

5) measure the length of the line "OA" with chain.

6) Continue the steps "4&5 processes at all other stations i.e B,C,D & E.

7) Calculate included angle θ_1 from bearings of OA & OB

8) Repeating step 7 process to calculate all other included angles θ_2, θ_3, θ_4, θ_5.

8) Calculating area of component triangles i.e A_1,A_2,A_3,A_4,A_5.

9) Calculating total area bounded by given points by adding up areas of all component triangles.

B) OBSERVATIONS AND TABULATIONS:

Line	Length(m)	Magnetic bearing	Included angle	Component triangle area(sq.mt)	Total area (sq.mt)

OA	16	30^0	$\theta_1=57^045'$	$A_1=121.78$	
OB	18	$87^045'$	$\Theta_2=67^0$	$A_2=165.69$	
OC	20	$154^045'$	$\Theta_3=60^040'$	$A_3=156.92$	
OD	18	$215^025'$	$\Theta_4=104^0$	$A_4=130.99$	
OE	15	$319^025'$	$\Theta_5=70^035'$	$A_5=113.18$	566.78

C) SPECIMEN CALCULATION:

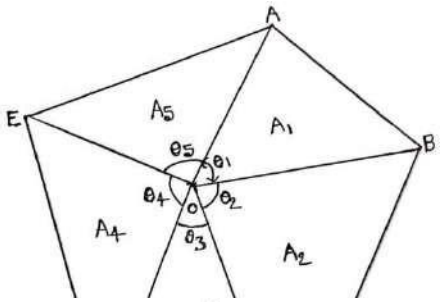
For triangle AOB,

Included angle(θ_1)=Whole Circle Bearing of line OB - Whole Circle Bearing of line OA

$= 87^045' - 30^0$

$= 57^045'$

Apply above procedure to calculate other included angles.

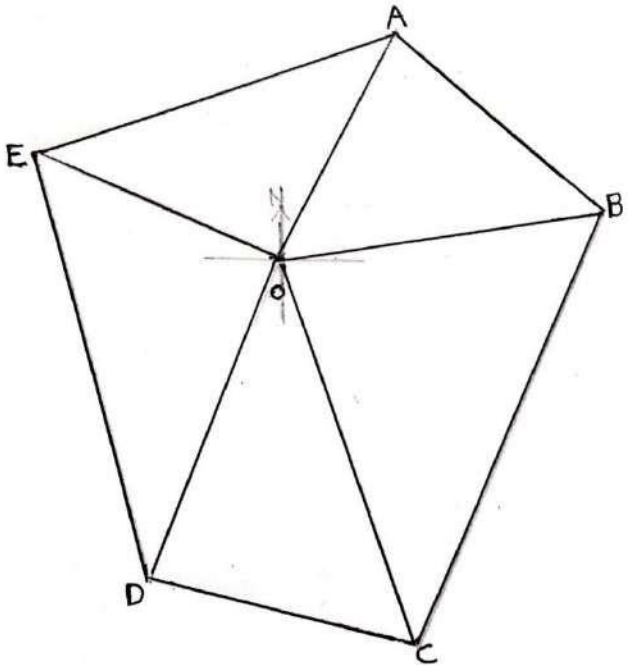


Component triangle area (A_1) = ½ * OA * OB* Sinθ_1

= ½ * 16 * 18 * Sin$57^045'$

= 121.78 sq.mt

Similarly area of other component triangles can be calculated.



Check: Sum of included angles = 360^0

=

$\theta_1+ \theta_2+ \theta_3+ \theta_{4+} \theta_5$

$=360^0$, hence o.k.

D) RESULT:

Total area bounded by given points= $A_1+A_2+A_3+A_4+A_5$=566.78 Sq.mt

E) PLOTTING:

1) Use the observations recorded in the table to draw the diagram on a drawing sheet.

2) Draw a line up the drawing sheet to represent the reference direction of the magnetic meridian and mark the instrument station 'O'.

3) Place the circular protractor with its center at ‘O’ and zero lined up with the reference direction. Mark on the drawing sheet against the protractor edge, the magnetic bearing of line ‘OA’

4) Remove protractor, draw the direction of line ‘OA’, draw the distance ‘OA’(by taking suitable scale) and plot the position of ‘A’.

5) Similarly by following above 3 & 4 steps process, draw the direction and mark the distance of OB,OC,OD & OE.

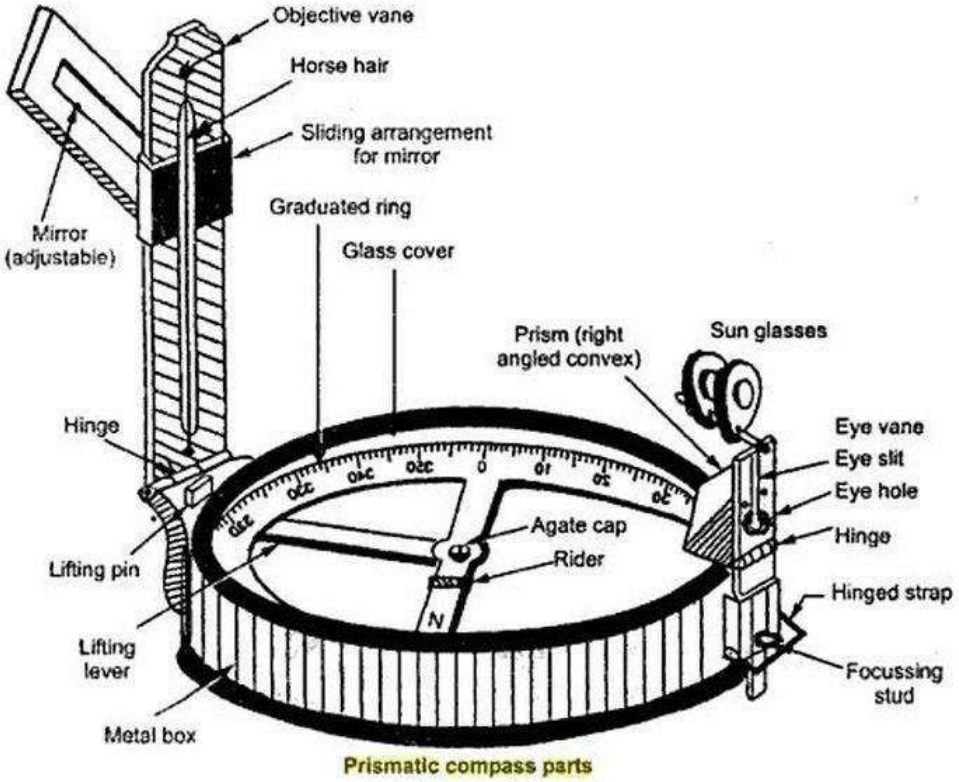
6) Join the station points A,B,C,D&E, which will indicate the plan of the plot.

F) INFERENCE:

Determine the distance between two accessible points involving single setting of the instrument.

A.THEORY

Prismatic compass is an instrument based on the principle that a freely suspended or pivoted magnetic needle point in the direction of magnetic meridian. The bearings of lines are obtained in the WCB system.



Prismatic compass parts

B.PROCEDURE

1. Let ‘A’ and ‘B’ are the two accessible points.

2. Let ‘O’ be the instrument station selected from which the bearings of the two points are visible.

3. By adjusting the legs of the tripod suitable centring will be done.

4. Centring is checked by dropping a stone from the bottom of the box so that it falls exactly over the peg.

5. Level the compass by means of ball and socket arrangement provided on the tripod.

6. When the compass is levelled the aluminium ring swings freely.

7. Focus the prism by sliding it up and down with the focus stud till the graduations are clearly visibly.

8. Sight the object at A and observe the bearing of the line OA.

9. Sight the object at B and observe the bearing of the line OB.

10. Using tape measure the distance OA and OB.

C.OBSERVATIONS AND CALCULATIONS:

Whole bearing of OA is α =

Whole bearing of OB is β =

$\Theta = 360^{o} - \alpha + \beta$ =

Length of OA=

Length of OB=

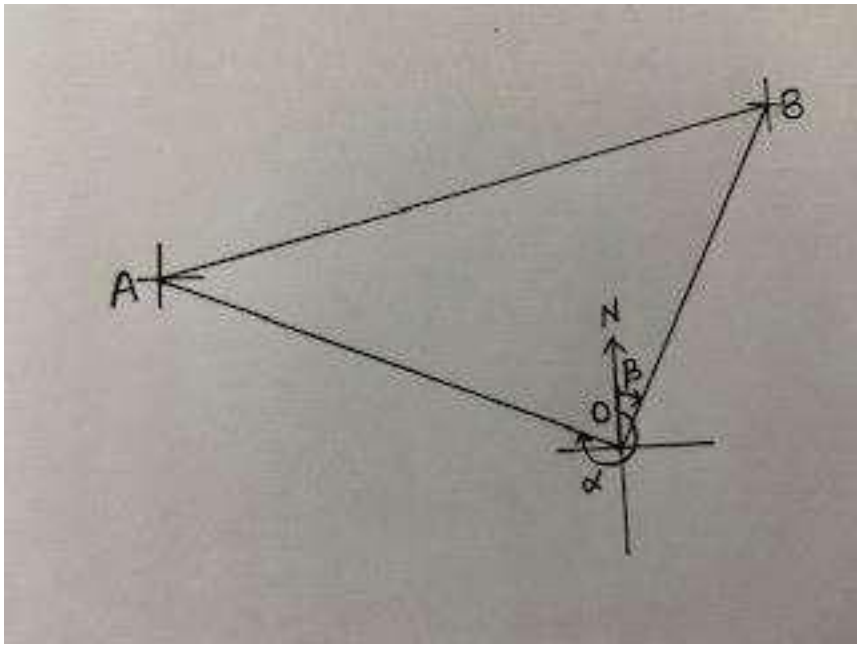
$AB = (OB^2 + OA^2 - 2*OA*OB*\text{Cos}\ \theta)^{1/2}$

D. RESULT

The distance between the two accessible points AB=

PLOTTING:

1. Draw a line indicating the magnetic meridian at O.
2. Draw a line OA at A to a suitable scale according to the measured distance and bearing of OA.
3. Draw a line OB at O to a suitable scale according to the measured distance and bearing of OB.
4. Join AB and measure the distance.


A
B
N
β
O
α

THE HORIZONTAL DISTANCE BETWEEN TWO INACCESSIBLE POINTS- COMPASS SURVEY

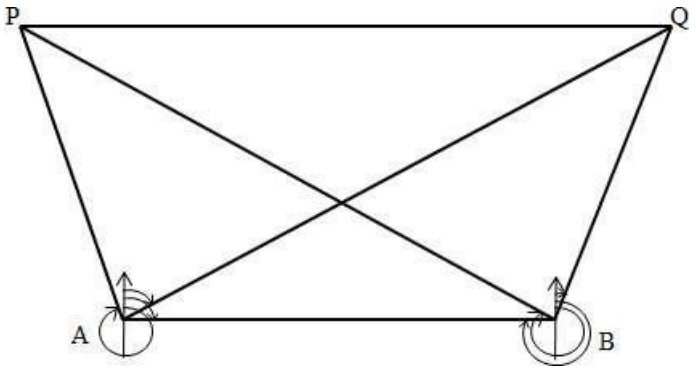
A. PROCEDURE

1. Identify the inaccessible points P and Q.

2. Mark points A and B on the ground at a known distance apart such that all triangles formed are well conditioned (P,Q,B SHOULD BE VISIBLE AT STATION A & P,Q,A SHOULD BE VISIBLE AT STATION B). Record the distance AB.

3. Set up the compass over 'A' and measure bearings of AP, AQ and AB.

4. Set up the compass over 'B' and measure the bearing of BA, BP and BQ.



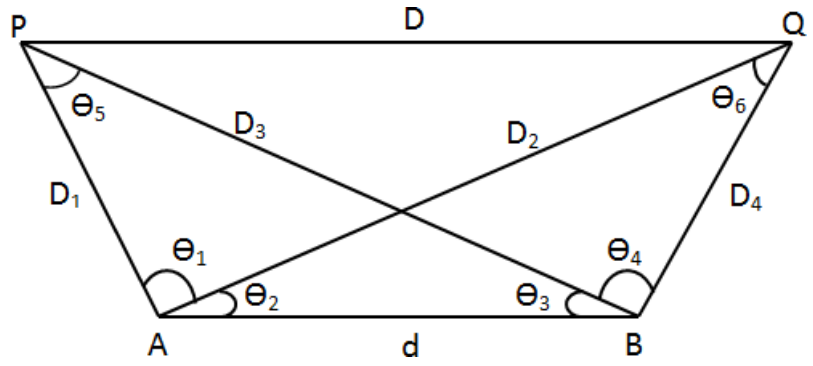
B. OBSERVATIONS AND TABULATIONS

1. Least count of compass : _____

2. Distance AB =_____m

Instrument at	Sighted to	Line	Bearing
A	P	AP	
	Q	AQ	
	B	AB	
B	P	BP	
	Q	BQ	
	A	BA	

C. SPECIMEN CALCULATIONS



Θ_1 = _____

Θ_2 = _____

Θ_3 = _____

Θ_4 = _____

$\Theta_5 = 180 - (\Theta_1 + \Theta_2) - \Theta_3$ = _____

$\Theta_6 = 180 - (\Theta_3 + \Theta_4) - \Theta_2$ = _____

From Δ^{le} ABP

$$\frac{D1}{sin\theta 3} = \frac{D3}{\sin(\theta 1 + \theta 2)} = \frac{d}{sin\theta 5}$$

D_1 =_____m

D_3 =_____m

From Δ^{le} ABQ

$$\frac{D2}{\sin(\theta 3 + \theta 4)} = \frac{D4}{\sin\theta 2} = \frac{d}{sin\theta 6}$$

D_2 =_____m

D_4 =_____m

From Δ^{le} APQ

$PQ^2 = AP^2 + AQ^2 - 2 \times AP \times AQ \times \cos\theta_1$

$D = (\sqrt{D_1^2 + D_2^2 - 2D_1D_2 \cos\theta_1})$

(OR)

From Δ^{le} BPQ

$PQ^2 = BP^2 + BQ^2 - 2 \times BP \times BQ \times \cos \theta_4$

$D = (\sqrt{D_3^2 + D_4^2 - 2D_3D_4 \cos \theta_4})$

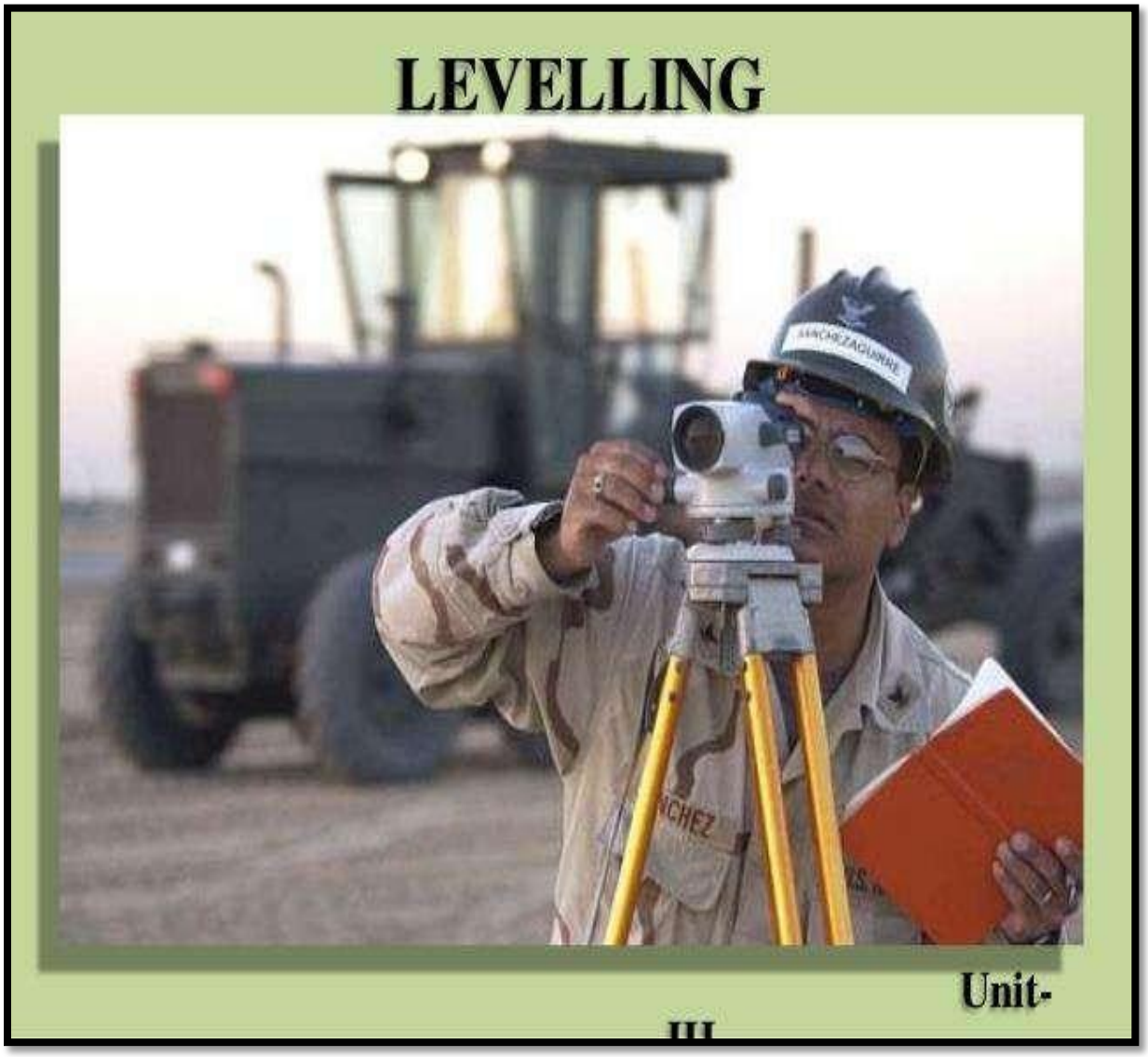
D. RESULT:

THE HORIZONTAL DISTANCE BETWEEN TWO INACCESSIBLE POINTS is_____

E. INFERENCE

EXPERIMENTAL METHODOLOGY 4.3.1 Identifying the parts of Dumpy Level and Study different Levelling Staves

L E V E L L I N G



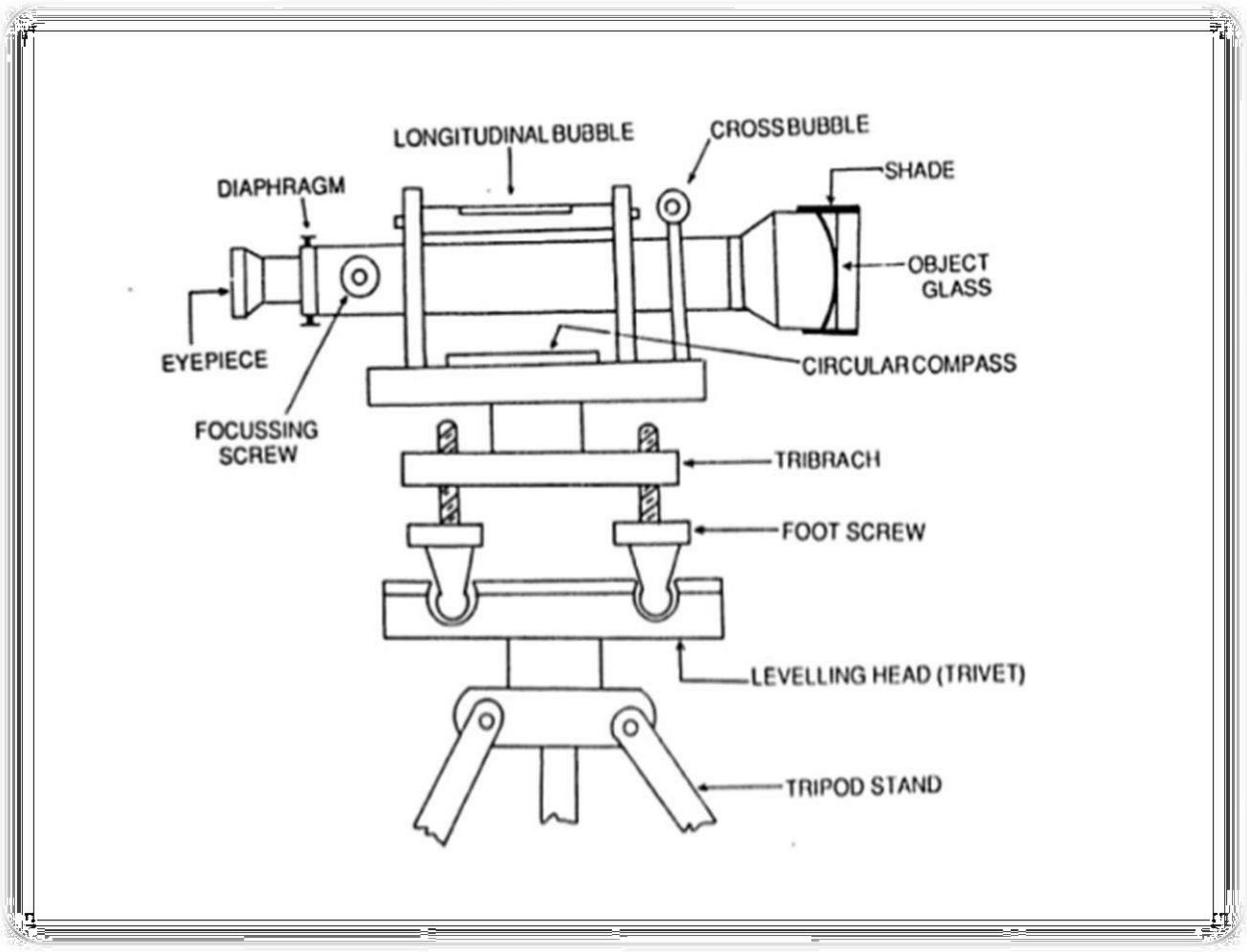
METHODOLOGY

3.1. IDENTIFY THE COMPONENT PARTS OF A DUMPY LEVEL AND STUDY DIFFERENT TYPES OF LEVELLING STAVES.

OBJECTIVE: To identify the component parts of a Dumpy Level and Study of different types of levelling staves.

INSTRUMENTS: A level and levelling staff.

FIGURE:



COMPONENT PARTS OF A DUMPY LEVEL

I. COMPONENT PARTS OF A DUMPY LEVEL

1. **TELESCOPE:** It contains of two metal tubes, one of which slides within the other one-tube carries the object glass and the second one carries eyepiece and diaphragm.
2. **FOCUSSING SCREW:** The telescope is focused by turning the focusing screw either forward or backward.
3. **BUBBLE TUBES:** The telescope is attached with two bubble tubes. One is longitudinal and the other is cross bubble tube. These two are placed at right angles to each other.
4. **DIAPHRAGM:** It carries cross hairs.

5. **TRIBRACH & TRIVET:** The telescope with vertical spindle is supported by two parallel triangular plates. The upper plate is called tribrach and the lower plate is called trivet
6. **FOOT SCREWS:** By turning the foot screws, the tribrach can be raised or lowered to bring the bubble to the centre of its run.

II. LEVELLING STAFF: It is used for measuring the vertical distance of the points above or below the horizontal line of sight. The different staves in use are

1. Sop with telescope staff
2. Folding staff
3. Solid staff
4. Target staff

1. SOP WITH TELESCOPE STAFF: It is usually arranged in three telescopic lengths. The staff is 4m long when fully extended. The top length 12.5m is solid slides into the central box of length 12.5m, which again slides in the bottom box of 1.50m long. The staff is provided with brass spring catches to keep the extended length in position.

The meter numerals are marked on the left side and are pointed in red. The decimetre numerals are marked on the right side and are pointed in black.

The background is painted in white. The smallest division on this staff is 5mm. The graduations are marked erect and are seen inverted when viewed through the telescope.

2. FOLDING STAFF: It is made of well-seasoned timber such as deodar, blue pine or aluminium. It is 4m long, 75mm wide, 18mm thick. It has two lengths of 2m each which are connected at the middle by a hinge so that the upper portion can be folded over the lower one.

The minimum division on the staff is 5mm. The lengths of meter in numerals are marked on the left and painted in black. The entire background is painted in white. The graduations are inverted and hence when viewed through the telescope, they appear erect.

3. SOLID STAFF: It consists only one length and is usually 3m long. It is also graduated in divisions of 5mm. This is used for precise levelling work.

4. TARGET STAFF: It consists of two lengths, one sliding over the other. It is graduated from top downwards. The target is equipped with Vernier, which is adjusted by the staff man. The target is to be moved along the rod until its centre is bisected by the line of sight. The target is then clamped and reading is taken. Target staves are used when the sights are long, say more than 100m.

INFERENCE:

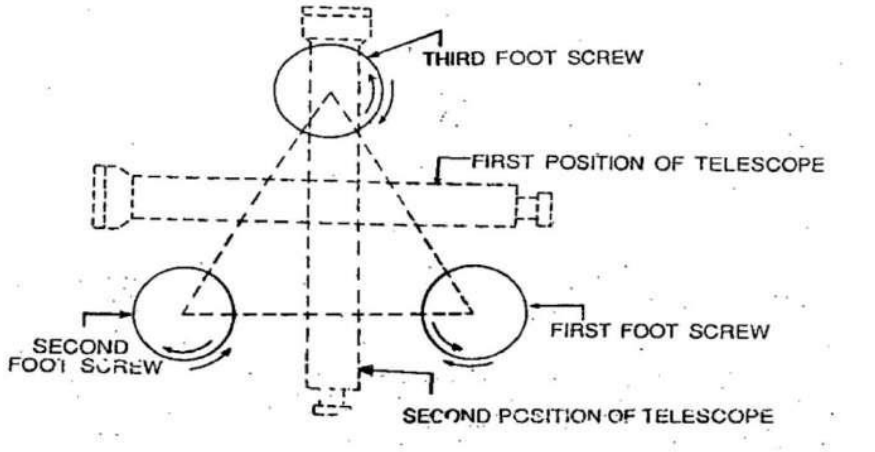
TO PERFORM TEMPORARY ADJUSTMENTS OF ADUMPY LEVEL IN SURVEYING

A. THEORY

Dumpy level is an instrument widely used in surveying and construction to measure height differences, to locate points on horizontal plane and to transfer, measure and set heights of known objects or marks.

B. PROCEDURE

1. Fixing the tripod.
2. setting up the instrument on tripod
3. Approximate levelling is done by tripod legs
4. Accurate levelling is done by centering the bubble tube by adjusting the foot screws.
5. The telescope is turned to 90^0 so that it lies on foot screw.
6. Turn back the telescope to its original position and check the bubble tube
7. Rotate the instrument by 180^0 and check the levelling
8. Focusing is done to eliminate parallax while taking reading on the levelling staff.
9. Focusing the eyepiece: Hold a white paper in front of telescope and rotate eyepiece in or out till the cross hairs are seen clearly and bisect each other.
10. Focusing the object: telescope is directed towards levelling staff and focusing screw is turned till the reading appears clear on levelling staff.
11. Taking the staff readings(Foresight, Backsight and intermediate sight)
12. Observations and tabulations.



C. OBSERVATIONS AND TABULATIONS:

station	B.S	I.S	F.S	H.I	R.L	Remarks	
A	1.895			32.395	30.500		
B		1.500			30.895		
C		1.865			30.530		
D	2.990		2.570	32.815	29.825	T.P1	
E	2.410		2.020	33.205	30.795	T.P2	
F		2.520			30.685		
G			2.960		30.245		
Sum	7.295		7.550				

D.RESULT:

E. REMARKS:

–

EXPERIMENTAL METHODOLOGY 4.3.3

DIFFERENCE IN ELEVATION BETWEEN TWO STATIONS USING DIFFERENTIAL LEVELLING

A. THEORY

Differential leveling is performed when the distance between two points is more. In this process, number of inter stations are located and instrument is shifted to each station and observed the elevation of inter station points. Finally difference between original two points is determined.

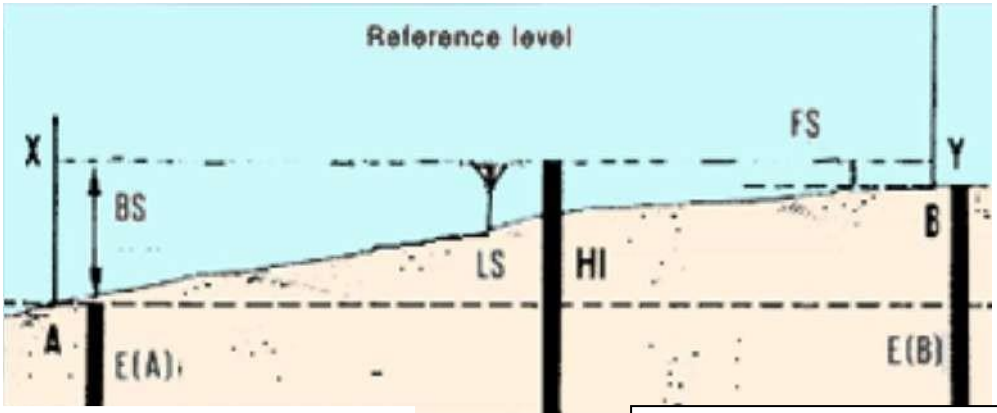
B. PROCEDURE

You can best understand differential levelling by first considering only two points, A and B , both of which you can see from one central levelling station, LS .

- Sight with a level from LS at the levelling staff on point A. The point where the line of sight meets the levelling staff is point X. Measure AX. This is called a backsight (BS).
- Turn around and sight from LS at the levelling staff on point B. The point where the line of sight meets the levelling staff is point Y. Measure BY. This is called a foresight (FS
- The difference in elevation between point A and point B equals BC or (AX- BY) or (back sight BS - foresight FS)
- If you know the elevation of A, called E(A), you can calculate the elevation of B, called E(B), as BS -FS + E(A).
- But BS + E(A) = HI, the height of the instrument or the elevation of the line of sight directed from the level
- Therefore,

$$E(B) = HI - FS$$

(The elevation at point B being equal to the height of the levelling instrument, minus the foresight).



EXPERIMENTAL METHODOLOGY 3.30 **Differential Levelling**

B. OBSERVATIONS AND TABULATIONS

a) AX = _____

b) BY = _____

c) E(A) = BM = Known Value

Point	BS	HI	FS	SS	Elevation

C. CALCULATIONS

a) AX = _____

b) BY = _____

c) BC = AX - BY = _____

d) E(A) = BM = Known Value

e) HI = BS + E(A)

f) E(B) = HI - FS

D.RESULT

Hence Difference in Elevation Is E(A) – E(B)

E.INFERENCE

_____

_____

_____

_____

EXPERIMENTAL METHODOLOGY 4.3.4

True Difference in Elevation Between Two far off Station by Using Reciprocal Levelling

A. THEORY

The difference in level between two points is accurately determined by setting up the instrument near each of the points and taking observation of staff reading on both. This method is adopted when it is not possible to set up the Level mid way between the points

B. PROCEDURE

1. Set up the Instrument near to Station A and carryout temporary adjustments.
2. Now keep the staff at station A and also at station B and take corresponding staff readings (i.e a1 ,b1 respectively)
3. Now shift the Instrument to station B and perform necessary temporary adjustments.
4. Now keep the staff at station B and also at station A and take corresponding staff readings(i.e b2 ,a2 respectively)

C. OBERVATIONS AND TABULATIONS

When the level is nearer to A

Correct staff reading at Aa1=m

Staff reading at B b1= m

When the level is nearer to B

Correct staff reading at B b2=m

Staff reading at A a2=m

D. CALCULATIONS

h= True difference of level between A & B

When the level is nearer to A

Correct staff reading at Aa1=m

Staff reading at B b1= m

When the level is nearer to B

Correct staff reading at B b2=m

Staff reading at A a2=m

$$h = \frac{(a1-b1)+(a2-b2)}{2}$$

E. RESULT

True elevation difference between two far off station points**A** and **B** =m

R.L of B =R.L of A + h

F. PRECAUTIONS :

1. Note down the readings without parallax
2. Centering and Levelling of the instrument should not be disturbed

DETERMINATION OF COLLIMATION ERROR OF A DUMPY LEVEL BY CONDUCTING RECIPORCAL LEVELLING

A. PRINCIPAL

A collimation error exists if the Line of Sight (LoS) is not horizontal when the instrument is leveled, refer Figure 1. The LoS will be inclined or depressed and is caused by incorrect vertical location of the crosshairs.

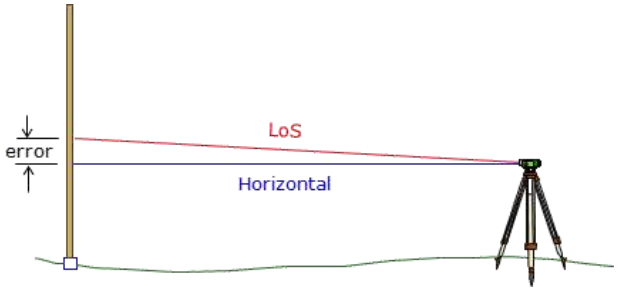


Figure 1
Collimation Error

Level Collimation is the process of determining the error present in an instrument. Once the error is determined, the instrument can be adjusted or the error can be mathematically applied to each reading made with the instrument. The drawback to mathematical error resolution is that the sight length of each reading is necessary since the error is a function of distance.

B. THEORY

Because collimation error cancels if BS and FS distances are balanced, the Level Collimation process purposely uses unbalanced sight distances. The elevation difference between two points is determined using a short BS / long FS condition followed by a long BS / short FS condition. If there is a collimation error, the two elevation differences will not be the same.

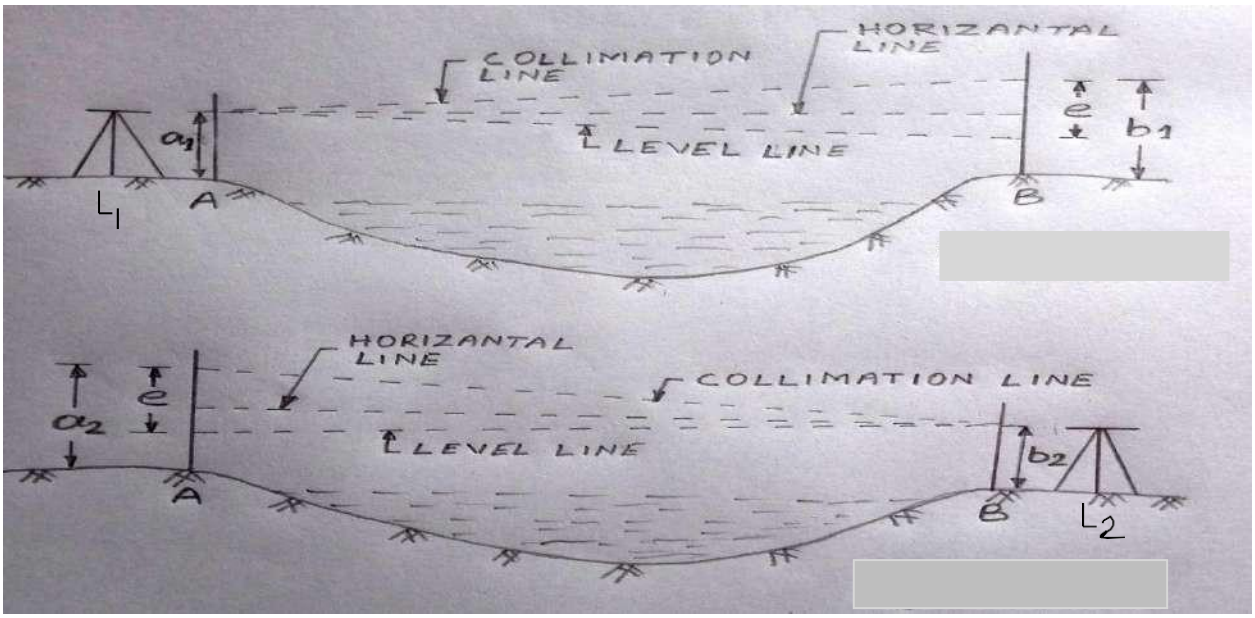
Because collimation error is a function of distance, the sight length for each reading is needed. The error is then stated as ratio (e.g. ft/ft) or angle above (+) or below (-) horizontal.

C. PROCEDURE

Let A and B be two points on the opposite banks of a river or a deep valley whose difference of elevation is to be determined. The following procedure is adopted,

1. Drive pegs at A and B. Set up the instrument near peg A at L1.
2. Take reading a1 and b1 on the staffs held at A and B respectively. The reading a1 will have to be taken through the objective if L1 is very near A.

3. Shift the instrument to station L2 near the peg B.
4. Take readings a2 and b2 on the staffs held at A and B respectively. The staff b2 will have to be taken through the objective.



Let d = true difference between A and B
e = error due to curvature refraction and collimation error

D. OBSERVATIONS AND TABULATIONS

a) From A the correct reading on staff held near B in the first set up (i.e., instrument near A) = $b_1 - e$

b) From A the true difference between A & B, d = $b_1 - e - a_1$
= $b_1 - a_1 - e$ ..... (1)

(c) From B the correct reading on A (i.e., instrument near B) = $a_2 - e$

(d) From B the true difference between A & B, d = $b_2 - (a_2 - e)$
= $b_2 - a_2 + e$ ..... (2)

(e) Adding both the equations, (1) & (2),

$2d = b_1 - a_1 - \cancel{e} + b_2 - a_2 + \cancel{e}$

$d\ (=e) = \frac{(b_1 - a_1) + (b_2 - a_2)}{2}$

(Total error, e)

$e = e_l + e_c - e_r$

EXPERIMENTAL METHODOLOGY 3. 5

Where, e_l = error of collimation ("+" when the line of collimation upwards)

e_c = error due to curvature = - $0.0785*d^2$ (d in KM)
e_r = error due to refraction = $0.0112*d^2$ (d in KM)

e_l = $e - e_c + e_r$

e_l = $e - 0.0785*d^2 + 0.0112*d^2$

e_l = $e - 0.0673*d^2$

S. No	Instrument at	Height of Instrument (m)	Staff above peg (m)	Staff reading	RL (m)
1	A	1.450	1.675	B	+ 30.480
2	B	1.425	0.980	A	Required

E.SPECIMEN CALCULATIONS

a_1 = 1.450 m, b_1 = 1.675 m, a_2 = 0.980 m, b_2 = 1.425 m and d (distance between A and B) = 700 m

(a) Finding collimation error,

Total Error, e = $\frac{(b_1 - a_1) - (b_2 - a_2)}{2}$

= $\frac{(1.675 - 1.450) - (1.425 - 0.980)}{2}$

= $\frac{0.225 - 0.445}{2}$

= - 0.110 m

Collimation error, e_l = $e - 0.0673*d^2$

= $-0.110 - 0.0673*(700/1000)^2$

= $-0.110 - 0.0673*(0.7)^2$

= -0.110 - 0.3297

= -0.14297 m in 700 m
(i.e., -14.297 cm in 700 m)

(b) Level Difference between A & B,

d = $\frac{(b_1 - a_1) + (b_2 - a_2)}{2}$

= $\frac{(1.675 - 1.450) + (1.425 - 0.980)}{2}$

= $\frac{(0.225 + 0.445)}{2}$

= 0.335 m

Therefore, RL of B = RL of A + d

= + 30.480 m + 0.335 m

= +30.815 m

F.GRAPH

NIL

G.RESULT

The collimation error of the given dumpy level by conducting reciprocal leveling was found to be_____.

H.INFERENCE

_____

_____

_____

_____

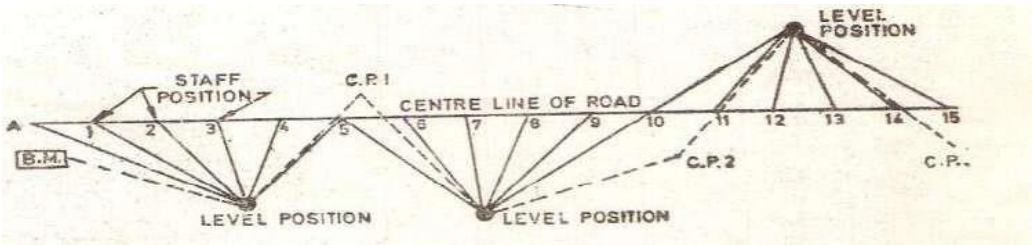
EXPERIMENTAL METHODOLOGY 4.3.6

TO PERFORM PROFILE LEVELLING ALONG ROUTE AND CALCULATE THE REDUCED LEVELS

A.OBJECTIVE

To perfom profile levelling along route and calculate reduced levels at various points.

B. PROCEDURE



1) Setting up the level on tripod
2) Do temporary adjustments to level
3) Take back sight on BM
4) Place the chain along the route
5) Mark the points at every 5m interval
6) Take intermediate sight at every point
7) Take change point if needed
8) Enter the last reading in fore sight
9) Calculate reduced levels
10) Apply checks

EXPERIMENTAL METHODOLOGY

PROFILE LEVELLING

B. OBSERVATIONS AND TABULATIONS

Station	Staff	Distance In meters	Staff Reading			Height of Instrument or		Reduced Level	Remarks
			Back (B.S)	Inter (I.S)	Fore (F.S)	Rise	Fall		
	BM		0.935			100.935		100	
		0		1.315		100.935		99.62	
	1	5		1.685		100.935		99.25	
	2	10		1.95		100.935		98.985	
	3	15		1.69		100.935		99.245	
	4	20		1.745		100.935		99.19	
	5	25		1.85		100.935		99.085	
			1.11		1.75	100.295		99.185	
	6	30		1.255		100.295		99.04	
	7	35		1.51		100.295		98.785	
	8	40		1.97		100.295		98.325	
	9	45		1.455		100.295		98.84	
	10	50			1.25	100.295		100.295	

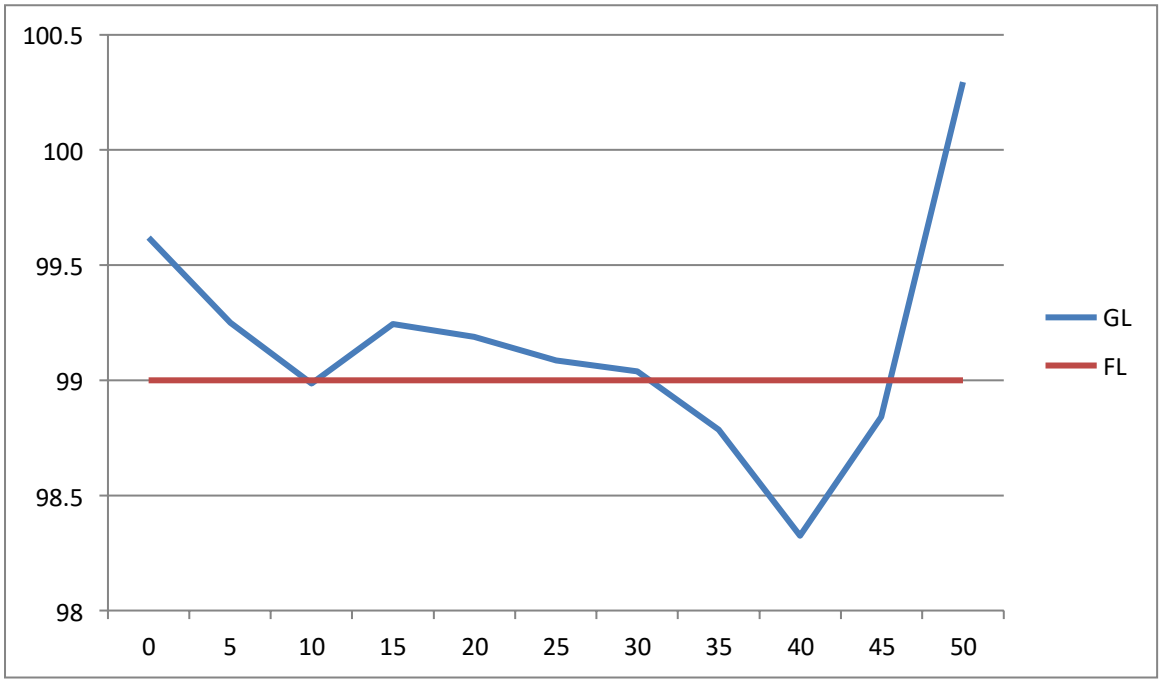
CALCULATIONS

EXPERIMENTAL METHODOLOGY 4. 1a

PROFILE LEVELLING

D.PLOTTING

Draw the graph such that distance on horizontal-axis and Reduced level on Vertical axis



D.RESULT

_____

_____

_____

EXPERIMENTAL METHODOLOGY 4.3.7

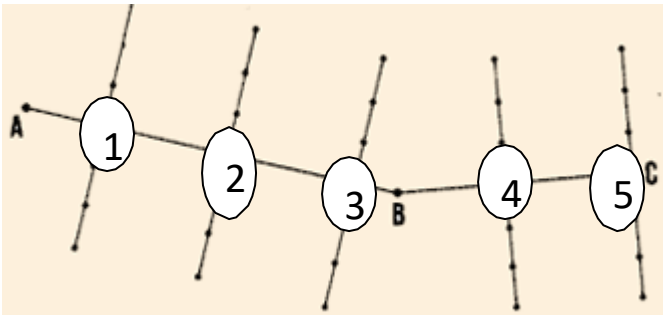
TO PERFORM PROFILE LEVELLING ALONG ROUTE AND CALCULATE THE REDUCED LEVELS

A.OBJECTIVE

To perfom profile levelling along cross section and calculate reduced levels at various points.

B. PROCEDURE

Cross-sections



11) Setting up the level on tripod
12) Temporary adjustments
13) Take back sight on BM
14) Place the chain along the route
15) Locate Different Points where cross sections are required i.e. 1,2,3 etc..
16) Along the point 1,Mark the Points at 2m interval along the cross section
17) Take two readings on left side and right side of the point 1
18) Take intermediate sight at every point
19) Take change point if needed
20) Repeat the process at all points along the route i.e. 1,2,3 etc..
21) Enter the last reading in fore sight
22) Calculate reduced levels
23) Apply checks

EXPERIMENTAL METHODOLOGY 3.7

PROFILE LEVELLING ALONG CROSS SECTION

B. OBSERVATIONS AND TABULATIONS

Station	Staff	Distance In meters	Staff Reading			Height of Instrument or		Reduced Level	Remarks
			Back (B.S)	Inter (I.S)	Fore (F.S)	Rise	Fall		
	BM		0.935			100.935		100	
		0		1.315		100.935		99.62	
	1	5		1.685		100.935		99.25	
	2	10		1.95		100.935		98.985	
	3	15		1.69		100.935		99.245	
	4	20		1.745		100.935		99.19	
	5	25		1.85		100.935		99.085	
			1.11		1.75	100.295		99.185	
	6	30		1.255		100.295		99.04	
	7	35		1.51		100.295		98.785	
	8	40		1.97		100.295		98.325	
	9	45		1.455		100.295		98.84	
	10	50			1.25	100.295		100.295	

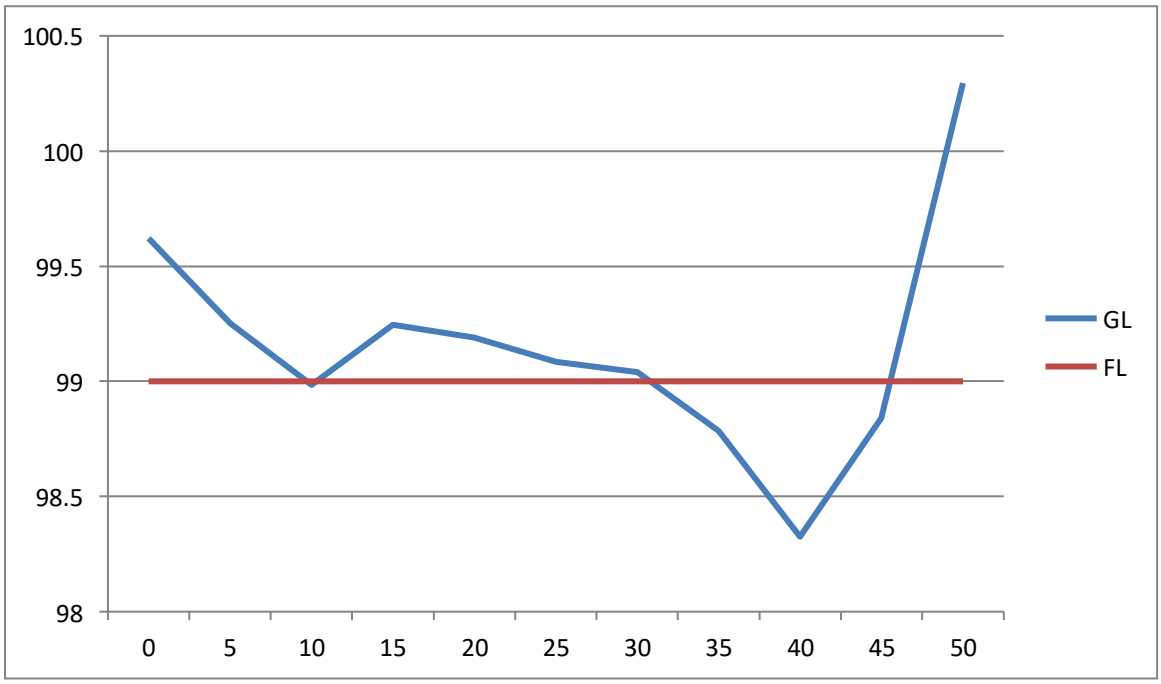
CALCULATIONS

EXPERIMENTAL METHODOLOGY 4. 1a

PROFILE LEVELLING

D.PLOTTING

Draw the graph such that distance on horizontal-axis and Reduced level on Vertical axis



D.RESULT

EXPERIMENTAL METHODOLOGY 4.3.8

TO CONDUCT PROFILE LEVELLING ALONG A ROUTE

A. THEORY

Dumpy level is an instrument widely used in surveying and construction to measure height differences, to locate points on horizontal plane and to transfer, measure and set heights of known objects or marks.

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.

B. PROCEDURE

1. The centre line is marked for the given route.
2. The main stations are marked along the centre line with fixed interval. the line joining these stations gives longitudinal section.
3. The points are marked on both sides of the main station across the centre line at each main station
4. The cross sections are obtained at each main station by joining the corresponding main station and the points on both the sides of it across the centre line
5. Fix the pegs on the stations
6. Fix the tripod on the instrument station
7. setting up the instrument on tripod
8. Approximate levelling is done by tripod legs
9. Accurate levelling is done by centering the bubble tube by adjusting the foot screws.
10. The telescope is turned to 90^0 so that it lies on foot screw.
11. Turn back the telescope to its original position and check the bubble tube
12. Rotate the instrument by 180^0 and check the levelling
13. Focusing is done to eliminate parallax while taking reading on the levelling staff.
14. Focusing the eyepiece: Hold a white paper in front of telescope and rotate eyepiece in or out till the cross hairs are seen clearly and bisect each other.
15. Focusing the object: telescope is directed towards levelling staff and focusing screw is turned till the reading appears clear on levelling staff.
16. Taking the staff readings(Foresight, Backsight and intermediate sight)
17. The instrument station can be changed when required and the readings are taken for the stations
18. The readings are tabulated and RLs are calculated for each station.
19. The graph is plotted for longitudinal section profile and cross sectional profiles.

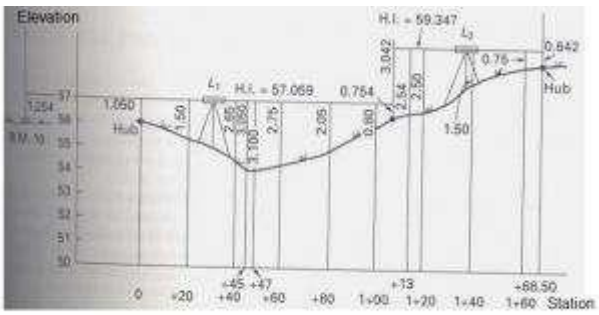
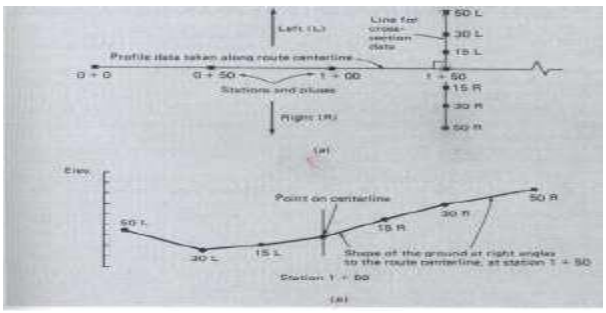


Figure 1: Profile leveling



C. OBSERVATIONS AND TABULATIONS:

station	B.S	I.S	F.S	H.I	R.L	Remarks	
A	1.895			32.395	30.500		
B		1.500			30.895		
C		1.865			30.530		
D	2.990		2.570	32.815	29.825	T.P1	
E	2.410		2.020	33.205	30.795	T.P2	
F		2.520			30.685		
G			2.960		30.245		
Sum	7.295		7.550				

D.RESULT:

E. REMARKS:

–

EXPERIMENTAL METHODOLOGY 4.3.9

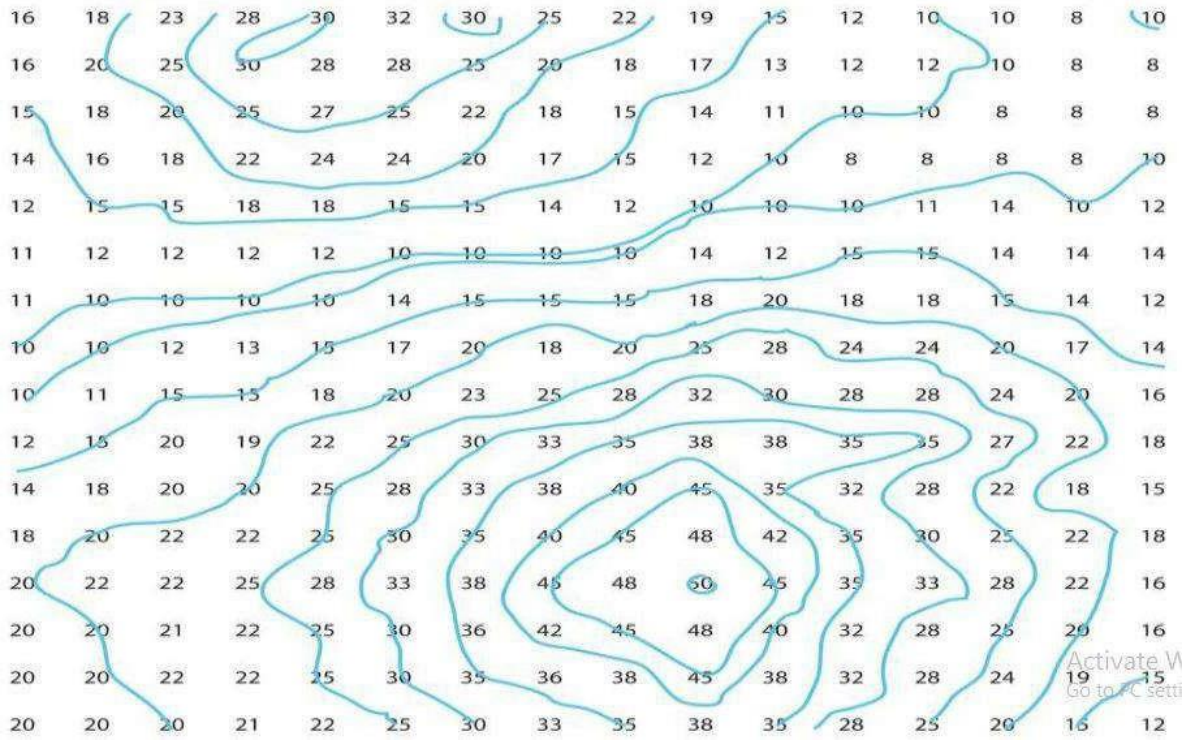
DETERMINATION OF GIVEN AREA BY BLOCK LEVELLING

A. THEORY

A contour may be defined as an imaginary line passing through points of equal elevation. A contour line may also be defined as the intersection of a level surface with the surface of the earth. The difference in the elevation of two adjoining contours on a contour map is known as the contour interval.

B. PROCEDURE

5. Set up the instrument at suitable position covering the entire area given.
6. Also check that the Bench Mark point is visible from level station.
7. Perform all temporary adjustments and take Back Sight reading on Bench Mark.
8. The entire area is divided into a number of squares of uniforms side say 5m or 10m depending upon the nature of ground and contour interval required.
9. The elevations of the corners of the square blocks are obtained with dumpy level.
10. The system of squares is plotted on paper and levels marked at all corners.
11. Contours are then drawn by linear interpolation.



C. OBSERVATIONS AND TABULATIONS

Station	B.S	I.S	F.S	H.I	R.L	Remarks
A						RL of BM = 100.000m

D.SPECIMEN CALCULATIONS

Height of Instrument = Reduced level of Bench Mark + Back Sight

=

Reduced Level of a point = Height of Instrument – Intermediate Sight / Fore Sight

=

Arithmetical Check: $\sum BS - \sum FS = \text{Last RL} - \text{First RL}$

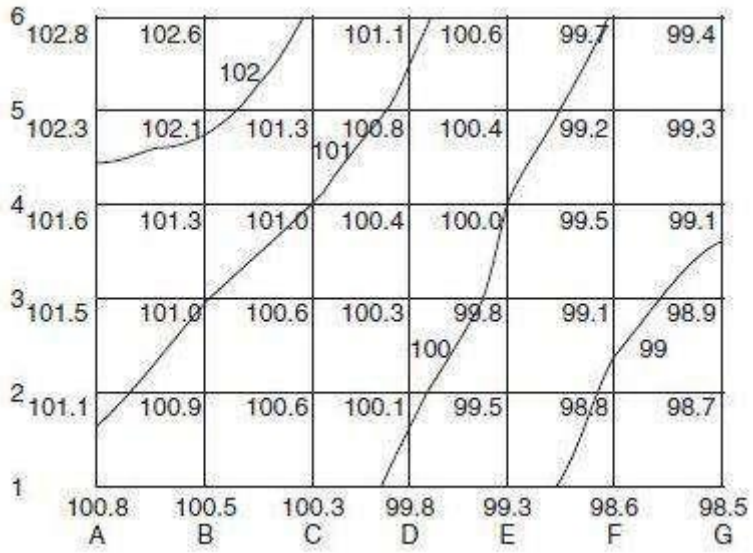
$\sum BS - \sum FS$ =

Last RL – First RL =

EXPERIMENTAL METHODOLOGY 3.9

Contouring by Block Levelling

E.PLOTTING



F.RESULT

Contours are plotted by linear interpolation by the method of squares on the given area.

DIRECT METHOD OF LOCATING CONTOUR POINTS (RADIAL METHOD)

THEORY: When the area is small and cab be measured from a single station, the method of radial line is adopted. In this method level staff is used for locating points. The position of points is obtained and then the contour map is plotted.

PROCEDURE:

1. Radial lines are set out from the common centre by compass or Theodolite and their positions are located by horizontal angles and bearings.

2. The temporary bench mark is set up first at the centre near the ends of radial line

3. The staff man holds the staff along the rays drawn from the instrument to the points of desired staff readings and the points A, B, C, D,E,F and G are marked on these rays on the ground.

4. The position of located contour points is determined by measuring their distances along the radial lines.

5. They are then plotted using plane table survey and the contours are drawn by joining these points.

C. OBERVATIONS AND TABULATIONS (for 60 contour)

S.NO	BS(m)	IS(m)	FS(m)	HI(m)	RL(m)	Remarks
1	1.500			62.500	61.000	BM
2		2.500			60.000	A1
3		2.500			60.000	B1
4		2.500			60.000	C1
5		2.500			60.000	D1
6		2.500			60.000	E1
7		2.500			60.000	F1
8			2.500		60.000	G1

D. CALCULATONS

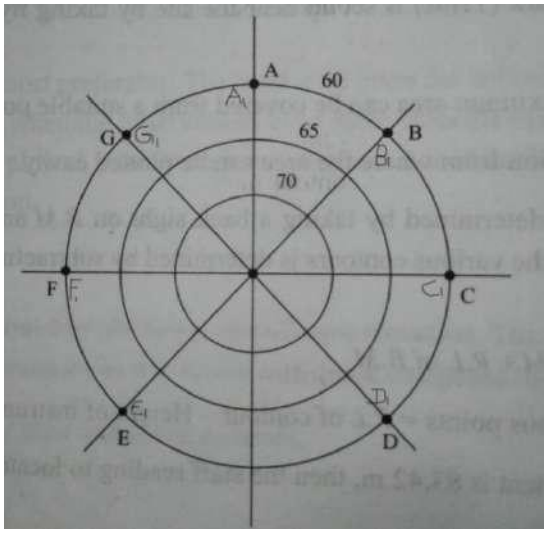
HI= RL of Bench mark + BS = 61.000+1.500=62.500

RL = HI – IS = 62.500 – 2.500 = 60.000

Arthmitcal check: $\sum$BS - $\sum$FS = Last RL – First RL = -1

E. RESULT

F. GRAPHS



CONTOUR MAP OF RADIAL METHOD

G. INFERENCES

H. PRECAUTIONS

1.Note down the readings without parallax.

2.One contour is located at a time.

Questions for VIVA-VOCE:

1. Chain Surveying:

1.1. Unfolding and folding a chain

a. **What** is the necessity of tallies in chain?

b. **What** is the number of oval rings available in between two links of a chain?

c. **Why** the brass metal is used for making handles of the chain?

1.2. Direct Ranging

a. **What** is the use of ranging rod in direct ranging?

b. **How** the direct ranging measurements are recorded?

1.3. Indirect Ranging

a. What is the necessity of indirect ranging?

b. What type of ranging is adopted, if a forest land is intervenes a survey line?

1.4. Setting a Right angle using chain ONLY

a. What is meant by offset?

b. What are the instruments used to set out right angle?

c. How many offsets are needed to locate the circular object?

1.5. Perpendicular and Oblique Offsets

a. What is the limiting length of offset?

b. How you distinguish perpendicular offset from oblique offset?

c. What is the necessity of oblique offset?

1.6. Triangulation survey with chain and cross-staff

a. How the index map is useful?

b. What is meant by triangulation?

c. What is the necessity of tie line?

d. Why ideal or well-conditioned triangle is preferred?

e. Why ill-conditioned triangle is not preferred?

1.7. Chain Triangulation survey – calculation of area -

a. Why the reference sketch is required?

b. What is the necessity of check line?

c. What is the necessity of base line?

1.8. Chain and Cross-staff Triangulation survey – calculation of area -

a. What you will do if cross-staff is not available to set perpendicular offset?

b. How the base line is useful for a cross-staff survey?

1.9. Chain survey – to overcome obstacles

a. What type of obstacles do the following features can be classified?

(i) Pond, (ii) River, (iii) Building, (iv) Rising Ground

b. What are the conventional signs of the following features?

(i) Pond, (ii) River, (iii) Building, (iv) Rising Ground

c. What is the mathematical theorem used in find out width of pond?

d. What is the triangluar concept used in width of river?

1.10. Chain Traversing

a. What type of traversing you has done in the field?

b. How do you adjust the closing error in a closed traverse?

2. Compass Surveying:

2.1. Identify the parts of a prismatic compass

a. Why the prismatic compass is used?

b. Why the magnetic needle is used in prismatic compass?

c. Why the prism is used in prismatic compass?

d. What is the function of sliding mirror in prismatic compass?

2.2. Setting of a prismatic compass – Temporary adjustments:

a. Why centring of prismatic compass is required?

b. Why levelling of prismatic compass is required?

2.3. Measurement of bearings and calculation of included angles using prismatic compass:

a. Distinguish WCB from QB.

b. What is the difference between FB and BB?

c. How the BB will be calculated using FB?

2.4. Perform a open traverse with both chain and compass:

a. What is the necessity of open traverse?

b. How the open traverse is check for accuracy?

2.5. Perform a closed traverse with both chain and compass:

a. Distinguish between closed traverse and open traverse.

b. What is the necessity of closed traverse?

c. How to check the closed traverse for accuracy?

2.6. Plot the closed traverse and adjust the closing error using bow ditch rule:

a. What is the closing error?

b. What is the permissible limit of closing error?

c. How the closing error is formed?

2.7. Radiation Method:

a. How the area is calculated using method of radiation?

b. How the accuracy of sum of the included angle at instrument station is checked?

2.8. Distance calculation by Single Setting of instrument:

a. Why the given points are called as accessible points?

b. What is the type of obstacle in this exercise?

2.9. Distance calculation by double Setting of instrument:

a. Why the given points are called as inaccessible points?

b. What is the type of obstacle in this exercise?

c. What is the triangular concept used to measure the distance in this exercise?

3. Levelling (**Field Exercises in Levelling)**:

3.1. Identify component parts of dumpy level and study different types of levelling staves:

a. What is the least count of telescopic levelling staff?

b. Which type of levelling stave is ideally suited for reciprocal levelling?

c. Distinguish self reading staff from target staff.

d. How the cross-hairs of the dumpy level are useful?

e. How the foot screws of dumpy level are useful?

3.2. Perform temporary adjustments of Dumpy level and practice taking staff readings and record them in field book:

a. Distinguish between BS and FS readings.

b. What is the necessity of IS reading?

c. What will happen, if temporary adjustments are not done to dumpy level?

d. How will enter the staff reading in the FB, when you shift instrument (dumpy level) station?

3.3. Differential levelling:

a. When will you go for invert level staff readings?

b. How will you calculate the RL of a station using Ht. of instrument method?

c. How will calculate the RL of a station using rise and fall method?

d. How will check the accuracy of IS readings?

e. Distinguish between differential levelling and fly levelling.

3.4. Reciprocal levelling:

a. How will you find out the true difference of levels between opposite banks of a river?

b. How will you take the staff readings, when the staff is very nearer to the dumpy level?

3.5. Collimation error of Dumpy Level:

a. How the curvature error is formed?

b. How the refraction error is formed?

c. Distinguish between collimation line and level line.

d. What will happen if relation between fundamental lines is not satisfied?

3.6. Conduct profile levelling - Longitudinal Sectioning:

a. Why the profile levelling is done along a route?

b. How the profile levelling is useful in real field work?

3.7. Conduct profile levelling – Cross Sectioning:

a. Why the profile levelling is done across a route?

b. How the profile levelling is useful in real field work?

3.8. Conduct profile levelling – both Longitudinal and Cross Sectioning:

a. Why the profile levelling is done along and across a route?

b. How the profile levelling is useful in real field work?

3.9. Block levelling:

a. How the block levelling in real life?

b. How the contour lines are interpolated?

c. How will you decide the size of square in Block levelling.

3.10. Radial Method of levelling:

a. How the inter visibility between two points can be determined from contour maps?

b. what is the difference between block levelling method and radial lines method in locating contours?

<u>Questions for Assessment:</u>

1. Chain Surveying:

1.1. Practice unfolding and folding a chain

a. Count the number of links in the given chain and express in_____numbers.

b. Measure the length of a link in the given chain and express in_____m.

c. Unfold the given chain.

d. Fold the given chain.

1.2. Direct Ranging

a. Direct ranging is used when the two end points are (accessible and visible).

b. Write any six hand signal used in direct ranging with their meaning.

c. Measure the distance between the two given points and record in the measurements FB.

1.3. Indirect Ranging

a. Choose the instruments needed in reciprocal ranging.

b. Measure the distance between the two given points when a high ground intervenes.

1.4. Setting a Right angle using chain ONLY

a. Establish a right angle to a given chain line by using chain ONLY.

b. Demonstrate the 3-4-5 rule.

1.5. Perpendicular and Oblique Offsets

a. Measure the length of perpendicular offset to a given object.

b. Set the oblique offset to a given object.

c. Set and measure offsets for a given chain line by,

i. perpendicular offsets and ii. Oblique offsets

1.6. Triangular survey with chain and cross-staff

a. Perform triangulation survey of the given area with chain and cross-staff and record the necessary details.

b. Measure the length of given tie.

1.7. Chain Triangulation survey – calculation of area -

a. Measure the lengths of sides of given triangle.

b. Divide the given area into well –conditioned triangles ONLY using a chain.

c. Calculate the area bounded by the given points by chain triangulation.

1.8. Chain and Cross-staff Triangulation survey – calculation of area -

a. Calculate the true area, if it is measured with a chain whose length is found to be 0.5 % too short, when the measured area was found to be 32 hectares?

b. Measure the length of altitude of the given triangle.

c. Calculate the area of given trapezium.

d. Calculate the area bounded by given points by chain and cross-staff.

1.9. Chain survey – to overcome obstacles

a. Measure the length of main survey line on one side of the building.

b. Set the perpendicular offset of main survey line.

c. Calculate the width of obstructed building by doing chain survey.

1.10. Chain Traversing

a. Measure the length of given traverse leg?

b. Fix the direction of given survey station.

c. Perform the chain traversing of the given area and plot the area.

2. Compass Surveying:

2.1. Identify the parts of a prismatic compass

a. Identify any three situations when compass survey is preferred over chain survey.

b. Identity the type of compass given to you.

c. Identify the parts of prismatic compass.

2.2. Setting of a prismatic compass – Temporary adjustments:

a. Setup the prismatic compass at a given station.

b. Perform the temporary adjustments of the prismatic compass.

2.3. Measurement of bearings and calculation of included angles using prismatic compass:

a. Measure the bearing of *a line formed between the* given points from instrument station.

b. Convert WCB 200^{o} to QB.

c. Calculate the included angle from the bearings measured using prismatic compass.

2.4. Perform an open traverse with both chain and compass:

a. Measure the length of a given traverse leg using the given chain.

b. Measure the bearing of the given traverse leg using the given prismatic compass.

c. Run an open traverse of the given area with both chain and prismatic compass.

2.5. Perform a closed traverse with both chain and compass:

a. Measure the length of a given traverse leg using the given chain.

b. Measure the bearing of the given traverse leg using the given prismatic compass.

c. Calculate the included angles between two traverse legs.

d. Run a closed traverse of the given area with both chain and prismatic compass.

2.6. Plot the closed traverse and adjust the closing error using Bowditch rule:

a. Plotting of the closed traverse done by the methods (parallel meridian method) and (included angle method).

b. Plot the closed traverse from the field data obtained by you.

c. Adjust the closing error from the above plotted closed traverse by Bowditch rule.

2.7. Radiation Method:

a. Measure the bearing of a given line by prismatic compass.

b. Calculate the included angle from the given bearings.

C. Calculate the area bounded by given points by the method of radiation using prismatic compass.

2.8. Distance calculation by Single Setting of instrument:

a. Set and measure the perpendicular offset to a given chain line.

b. Calculate the distance between two accessible points by single setting of prismatic compass.

2.9. Distance calculation by double Setting of instrument:

a. Set the perpendicular offset to the given chain line.

b. Calculate distance between two inaccessible points by setting of prismatic compass at two stations.

3. Levelling (**Field Exercises in Levelling)**:

3.1. Identify component parts of dumpy level and study different types of levelling staves:

a. Identify the component parts of dumpy level.

b. Identify the different types of levelling staves.

3.2. Perform of temporary adjustments of Dumpy level and practice taking staff readings and record them in field book:

a. Perform cantering operation of the given dumpy level over the given instrument station.

b. Perform focussing operation of the eye-piece and objective lens of the given dumpy level.

c. Perform the levelling operation of the given dumpy level and take the staff reading of the given station point and record the reading in field book.

3.3. Differential levelling:

a. Perform temporary adjustments of a dumpy level.

b. Take staff readings for the given stations involving change of dumpy level station (include invert level staff readings also).

c. Calculate the RLs of all the above stations using given dumpy level in differential levelling exercise and perform arithmetic check also.

3.4. Reciprocal levelling:

a. Perform the temporary adjustments of the dumpy level.

b. Taking staff readings for the given stations in reciprocal levelling.

c. Calculate true difference in elevation between two far off stations in reciprocal levelling.

3.5. Collimation error of Dumpy Level:

a. Take staff reading for the given stations in reciprocal levelling.

b. Calculate total error from the above staff readings.

c. Calculate collimation error of a dumpy level.

3.6. Conduct profile levelling - Longitudinal Sectioning:

a. Perform temporary adjustments of given dumpy level.

b. Take staff readings of given stations along the given route and record them level FB.

c. Calculate the RLs of the above stations along the given route and perform arithmetical check.

3.7. Conduct profile levelling – Cross Sectioning:

a. Perform temporary adjustments of given dumpy level.

b. Take staff readings of given stations across the given route and record them level FB.

c. Calculate the RLs of the above stations across the given route and perform arithmetical check.

3.8. Conduct profile levelling – both Longitudinal and Cross Sectioning:

a. Take staff readings of given stations along the given route and record them level FB.

b. Take staff readings of given stations across the given route and record them level FB.

c. Calculate the RLs of the above stations along and across the given route and perform arithmetical check.

3.9. Block levelling:

a. Divide the given area into squares using chain (or tape) and cross-staff.

b. Take the staff readings at all corners of the squares and record in the FB in the block levelling exercise.

c. Calculate RLs of corners of squares of block levelling and plot the suitable contours.

3.10. Radial lines Method of contouring:

a. Range out radial lines from a common centre in the given area using compass.

b. Locate points of same R.L using Dumpy Level on the different radial lines in the Radial lines method exercise for locating contours.