

# I

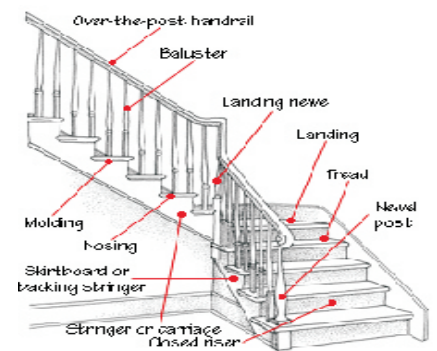
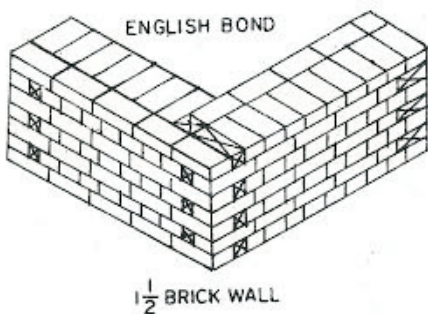
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Roll No. \_\_\_\_\_ Year 20 \_\_\_\_\_ 20 \_\_\_\_\_

Exam Seat No. \_\_\_\_\_

**CIVIL GROUP | SEMESTER - III | DIPLOMA IN ENGINEERING AND TECHNOLOGY**

## A LABORATORY MANUAL FOR BUILDING CONSTRUCTION (22304)



**MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI**  
(Autonomous) (ISO 9001 : 2015) (ISO / IEC 27001 : 2013)

## **VISION**

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

## **MISSION**

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

## **QUALITY POLICY**

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

## **CORE VALUES**

MSBTE believes in the followings:

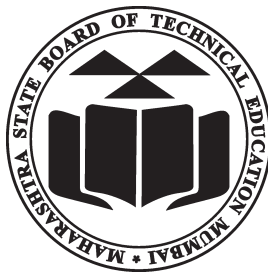
- Education industry produces live products.
- Market requirements do not wait for curriculum changes.
- Question paper is the reflector of academic standards of educational organization.
- Well designed curriculum needs effective implementation too.
- Competency based curriculum is the backbone of need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

**A Laboratory Manual**  
**for**  
**Building Construction**

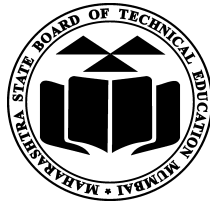
**(22304)**

**Semester-III**

**(CE/CR/CS)**

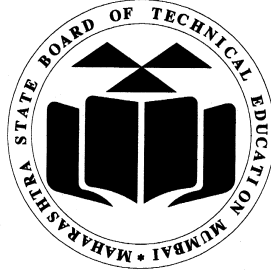


**Maharashtra State**  
**Board of Technical Education, Mumbai**  
**(Autonomous) (ISO:9001:2015) (ISO/IEC 27001:2013)**



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

(Printed on June, 2018 )



**MAHARASHTRA STATE  
BOARD OF TECHNICAL EDUCATION**

**Certificate**

This is to certify that Mr. / Ms. ....  
Roll No. ...., of Third Semester of Diploma in  
..... of Institute,  
.....  
(Code: .....) has completed the term work satisfactorily in course  
**Building Construction (22304)** for the academic year 20..... to 20..... as  
prescribed in the curriculum.

Place: .....

Enrollment No:.....

Date: .....

Exam. Seat No: .....

**Subject Teacher**

**Head of the Department**

**Principal**





## Preface

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

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

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

Building Construction is a core subject in Civil Engineering, which deals with the construction processes of sub structure, super structure, Building finishes and maintenance of buildings. This course essentially imparts the knowledge of construction technology along with the processes involved in it and various construction equipments used for effective execution of various construction activities. This knowledge shall be used for effective and efficient up keeping of building after construction. This will enable the students to undertake the activities in comparatively shorter period of time

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



## Programme Outcomes (POs) to be achieved through Practicals of this Course

*PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.*

*PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.*

*PO 3. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems.*

*PO 4. **Engineering tools:** Apply relevant Civil technologies and tools with an understanding of the limitations.*

*PO 8. **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.*

*PO 9. **Communication:** Communicate effectively in oral and written form.*

### Program Specific Outcomes (PSOs)

**PSO 2. Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

## List of Industry Relevant Skills

The following industry relevant skills of the competency 'Implement safe building construction practices' are expected to be developed in you by undertaking the practicals of this laboratory manual.

1. Identify components of building structures.
2. Demonstrate the purpose of each component
3. Select materials required for the components
4. Propose suitable type of foundation for building structures
5. Set out foundation plan on ground
6. Measurement skill
7. Set out perpendicular on the ground
8. Plot the center line on ground.
9. Set the diagonals for proposed building.
10. Select appropriate material for construction of wall
11. Construct the brick wall in English and Flemish bond
12. Maintain verticality and horizontality of wall
13. Select the materials for scaffolding, formwork and centering
14. Select relevant scaffolding for work
15. Erect the scaffolding, formwork and centering
16. Check the level of scaffolding, formwork and centering
17. Propose relevant means of communications for different types of buildings.
18. Select the staircase on the basis of utility
19. Draw plan, sectional elevation of a staircase
20. Locate the position of Door and Window
21. Execute the process of flooring and roofing
22. Identify defects in flooring, roofing, plastering and suggest remedial measures

23. Apply relevant method of plastering
24. Measure surface evenness using plumb bob
25. Select suitable type of masonry for building structures.
26. Select the relevant material for finishing works and waterproofing.
27. Apply relevant method of painting
28. Execute safe practices in building construction activities

### Practical- Course Outcome matrix

<b>Course Outcomes (COs)</b>							
a. Identify components of building structures. b. Propose suitable type of foundation for building structures. c. Select suitable type of masonry for building structures. d. Propose relevant means of communications for different types of buildings. e. Select the relevant material for finishing works. f. Execute safe practices in building construction activities							
S. No.	Practical Outcome	CO a.	CO b.	CO c.	CO d.	CO e.	CO f.
1	Identify components of building structures in the given model.	√		-	-	-	-
2 & 3	Prepare foundation plan to mark layout on the ground of the load bearing structure from the given building plan.(Part I & Part II)	-	√	-	-	-	-
4 & 5	Prepare foundation plan to mark layout <b>on the ground</b> of the framed structure from the given building plan.(Part I & Part II)	-	√	-	-	-	-
6	Assemble $1\frac{1}{2}$ Brick thick wall in a English Bond, (minimum 3 Course)	-	-	√	-	-	-
7	Assemble $1\frac{1}{2}$ brick thick wall in a Flemish Bond. (minimum 3 Course)	-	-	√	-	-	-
8	Prepare a simple stone masonry construction work.	-	-	√	-	-	-
9 & 10	Prepare a report on visit to construction site with respect to scaffolding, formwork and centering work.(Part I & Part II)	-	-	√	-	-	-
11	Identify various components of staircase in the given model.	-	-		√	-	-
12	Identify various components of doors and windows in the lab in the model to prepare the report with sketches.	-	-		√	-	-
13	Identify various types of flooring and roofing materials in the lab to prepare report.(Part I)	-	-	-	-	√	-
14	Identify various types of flooring and roofing materials in the lab to prepare report.( Part II)	-	-	-	-	√	-
15	Record the observation of plastering and pointing work at construction site to prepare a report.	-	-	-	-	√	-
16	Record the observation of painting in residential / public building work to prepare a report.	-	-	-	-	√	-

17	Carryout market survey for identifying various water proofing materials and prepare a report.	-	-	-	-		√
18	Prepare a sketch book consisting of all the sketches from practical Number 1, 2, 4, 6, 7,11,12	√	√	√	√	√	√

## **Guidelines to Teachers**

Teachers shall discuss the following points with students before start of practical of the subjects.

1. Learning Overview: To develop better understanding of importance of the subject. To know related skills to be developed such as intellectual skills and motor skills.
2. Know your laboratory work: To understand the layout of laboratory, specifications of equipment/instrument/materials, procedure, working in groups, planning time etc. also to know total amount of work to be done in the laboratory.
3. Teachers shall ensure that required equipment are in working condition before start each practical, also keep operating instruction manual available.
4. Explain prior concepts to the students before starting of each practical.
5. Evolve student's activity at the time of conduct of each practical.
6. While taking reading /observation each student shall be given a chance to perform/observe the practical.
7. List of questions is given at the end of each practical. Teachers shall allot the question to the students given at the end of practical/exercise. Teachers shall ensure that each student writes the answers to the allotted questions in the laboratory manual after performance is over.
8. If the practical set up has variations in the specifications of the practical, the teachers are advised to make the necessary changes, wherever needed.
9. Teachers shall assess the performance of the students continuously as prescribed by MSBTE norms and the guide lines issued from time to time.
10. Teacher is expected to share the skills to be developed in the students.
11. Teacher should ensure that the respective skills are developed in the students after the completion of the practical exercise.
12. Teacher may provide additional knowledge and skills to the students even though not covered in the manual but are expected from the students by the industries.
13. Teacher shall ensure that industrial visit recommended in the manual is covered.
14. Teacher may suggest the students to refer additional related literature of the technical papers/reference/books/seminar proceeding etc.
15. Focus should be given on development of enlisted skills rather than theoretical/codified knowledge. During assessment teachers is expected to ask questions to the students to tap their achievements regarding related knowledge and skills.
16. Teachers should organized Group discussions/brain storming sessions/seminars to facilitate the exchange of knowledge amongst the students.
17. Teachers should give more focus on hands on skills and should actually share the same.
18. Teachers should give guidelines to students to prepare the sketch book as mention in practical outcome sr. no.18  
Note: Kindly do add specific guidelines for effective implementation of practicals depending upon your course, if needed.

### **Instructions for Students**

1. For effective implementation and attainment of practical outcomes, in the beginning itself of each practical, students need to read through the complete write-up including the practical related questions and assessment scheme of that practical sheet.
2. Student ought to refer the data books, IS codes, Safety norms.
3. Before performing the practical student must read the lab manual of the related practical to be conducted.
4. Students should develop habit to submit the practical on date and time
5. Student should well prepare while submitting write-up of exercise
6. Students should prepare the sketch book as mention in practical outcome sr. no.18

## Contents

### List of Practicals and Progressive Assessment Sheet

S. No.	Title of the Practical	Page No.	Date of performance	Date of submission	Assessment marks(25)	Dated sign. of teacher	Remarks (if any)
1	Identify components of building structures in the given model.	1					
2 & 3	Prepare foundation plan to mark layout on the ground of the load bearing structure from the given building plan.(Part I & II)	8					
4 & 5	Prepare foundation plan to mark layout <b>on the ground</b> of the framed structure from the given building plan.(Part I & II)	14					
6	Assemble $1\frac{1}{2}$ Brick thick wall in a English Bond, (minimum 3 Course)	21					
7	Assemble $1\frac{1}{2}$ brick thick wall in a Flemish Bond. (minimum 3 Course)	27					
8	Prepare a simple stone masonry construction work.	33					
9	Prepare a report on visit to construction site with respect to scaffolding, formwork and centering work.(Part I)	39					
10	Prepare a report on visit to construction site with respect to scaffolding, formwork and centering work.( Part II)	39					
11	Identify various components of staircase in the given model.	48					

12	Identify various components of doors and windows in the lab in the model to prepare the report with sketches.	55					
13	Identify various types of flooring and roofing materials in the lab to prepare report.(Part I)	62					
14	Identify various types of flooring and roofing materials in the lab to prepare report.( Part II)	68					
15	Record the observation of plastering and pointing work at construction site to prepare a report.	74					
16	Record the observation of painting in residential / public building work to prepare a report.	81					
17	Carryout market survey for identifying various water proofing materials and prepare a report.	87					
18	Prepare a sketch book consisting of all the sketches from practical Number 1, 2, 4, 6, 7,11,12						
Total							

*Note: to be transferred to proforma of CIAAN 2017*



## Practical No. 1: Components of Building Structure

### I Practical Significance

The knowledge of components of building is a primary requirement for civil Engineering. The information regarding components, help to understand location of various components in a building. Building can be broadly divided into two parts. a) Substructure and b) Superstructure. The portion of the building below the ground is known as substructure and the portion above the ground is called superstructure.

### II Relevant Program Outcomes (POs)

PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PO 9. **Communication:** Communicate effectively in oral and written form.

PSO 2. **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### III Relevant Course Outcomes

a. Identify components of building structures.

### IV Practical Outcome

Identify components of building structure in the given model

### V Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency, “**Implement safe building construction practices.**”

1. Measurement skill
2. Identify components of building structures.
3. Demonstrate purpose /function of each component
4. Select material required for relevant component

### VI Relevant Affective domain related

a. Handle the model carefully.

### VII Minimum Theoretical Background

1. Types of building as per the national building of India – 2016 may be referred..
2. Components of structure
  - a. **Foundation**-Lowest prepared part below the surface of the surrounding ground which is in direct contact with sub-strata and transmits all the loads to the ground.
  - b. **Plinth**-It is the part of the structure above the surface of the surrounding ground up to the surface of the floor immediately above the ground.
  - c. **Super structure**- It is that part of structure which is constructed above plinth level.

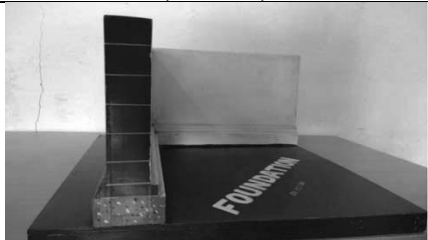

**VIII Experimental Set-up**



**Figure1: Component parts of building**

\*Note: - Students should be asked to draw schematic diagram showing component parts of Building.

**IX Resources required**

Sr. No.	Particulars	Specification	Quantity	Remark (Photos)
1	Model of building	Model showing all component parts of Substructure	1	
2	Model of building	Model showing all component parts of superstructure	1	

**X Procedure:-**

1. Conduct the visit to model room.
2. Identify the components of substructure.
3. Identify the components of superstructure.
4. Categorize the function of each component part
5. Identify material used for each component

**XI Precautions to be followed**

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**XII Actual procedure followed (To be written by students)**

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 .....

**XIII Resources used**

Sr. No.	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
1					
2					
3					
4					

**XIV Precautions followed**

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**XV Observations**

Sr. No.	Component part of structure	Section of component



**XVI Results**

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**XVII Interpretation of results**

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**XVIII Conclusions and Recommendations (if any)**

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### XIX Practical Related Questions

**Note:** Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO. Write answers of minimum three questions.

1. Explain component parts of substructure.
2. Explain component parts of superstructure
3. Explain type of foundation shown in model
4. Draw a section of building showing all component parts

(Space for Answers)

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**XX References / Suggestions for further Reading**

S. No.	Title of Book	Author	Publication
1.	Building Construction	S. P. Arora and S.P. Bindra	Dhanpat Rai Publication, Delhi Edition 2013, ISBN: 9788189928803
2.	A to Z Building Construction	Sandip Mantri	Satya Prakashan; New Delhi (2015) ISBN-13: 978-8176849692
3.	National Building Code	<b>BIS</b>	Bureau of Indian Standard, New Delhi
4.	BIS 962-1989 Code of Architectural and Building Drawing	<b>BIS</b>	Bureau of Indian Standard, New Delhi

**XXI Suggested Assessment Scheme**

Performance Indicators		Weightage (%)
<b>Process related:15 Marks</b>		<b>60%</b>
1	Identifying the components of substructure	10%
2	Identifying the component parts of superstructure.	15%
3	Suggestion of material used for component parts.	20%
4	Proportionate drawing of component parts	10%
6	Working in team.	5%
<b>Product related:10 Marks</b>		<b>40%</b>
7	Answers to practical related questions.	30%
8	Submission of report in time.	10%
<b>Total: 25 Marks</b>		<b>100%</b>

**List of Student Team Members**

- 1.....
- 2.....
- 3.....
- 4.....

Marks Obtained			Dated sign of Teacher
Process Related (15)	Product Related (10)	Total (25)	

## **Practical No. 2 & 3: Foundation Plan for Load Bearing Structure (Part I & Part II)**

### **I Practical Significance**

Building Construction is a core subject in Civil Engineering, which deals with the construction processes of sub structure, super structure, building finishes and maintenance of buildings. A diploma civil engineer is required to have the competency of laying down the centre line and mark the foundation plan on the ground before the excavation of foundation trenches. It also requires to maintain the perpendicular at the corners particularly and to verify the same by measuring the diagonals from opposite corners using the Pythagoras principle (i.e.3, 4, 5 method). This practical will develop the aforesaid competency in the students.

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

- PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.
- PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.
- PO 4. **Engineering tools:** Apply relevant Civil technologies and tools with an understanding of the limitations.
- PO 8. **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.
- PSO 2. **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### **III Relevant Course Outcomes**

- a. Propose the suitable type of foundation for building structures.

### **IV Practical Outcome**

Prepare foundation plan to mark layout on the ground of the load bearing structure from the given building plan(Part I)

### **V Competency and Practical Skills**

This practical is expected to develop the following skills for the industry identified competency, “Implement safe building construction practices”.

1. Measurement skill
2. Set out perpendicular on the ground
3. Plot the center line
4. Set the diagonals for proposed building

### **VI Relevant Affective domain related**

- a. Follow safety practices & precautions.
- b. Demonstrate working as a leader/a team member.
- c. Maintain tools and equipment.



## VII Minimum Theoretical Background

1. Knowledge of scale
2. Pythagoras principle
3. Foundation plan
4. Skill of transferring the plan on ground.

## VIII Experimental Set-up: (sample plan)

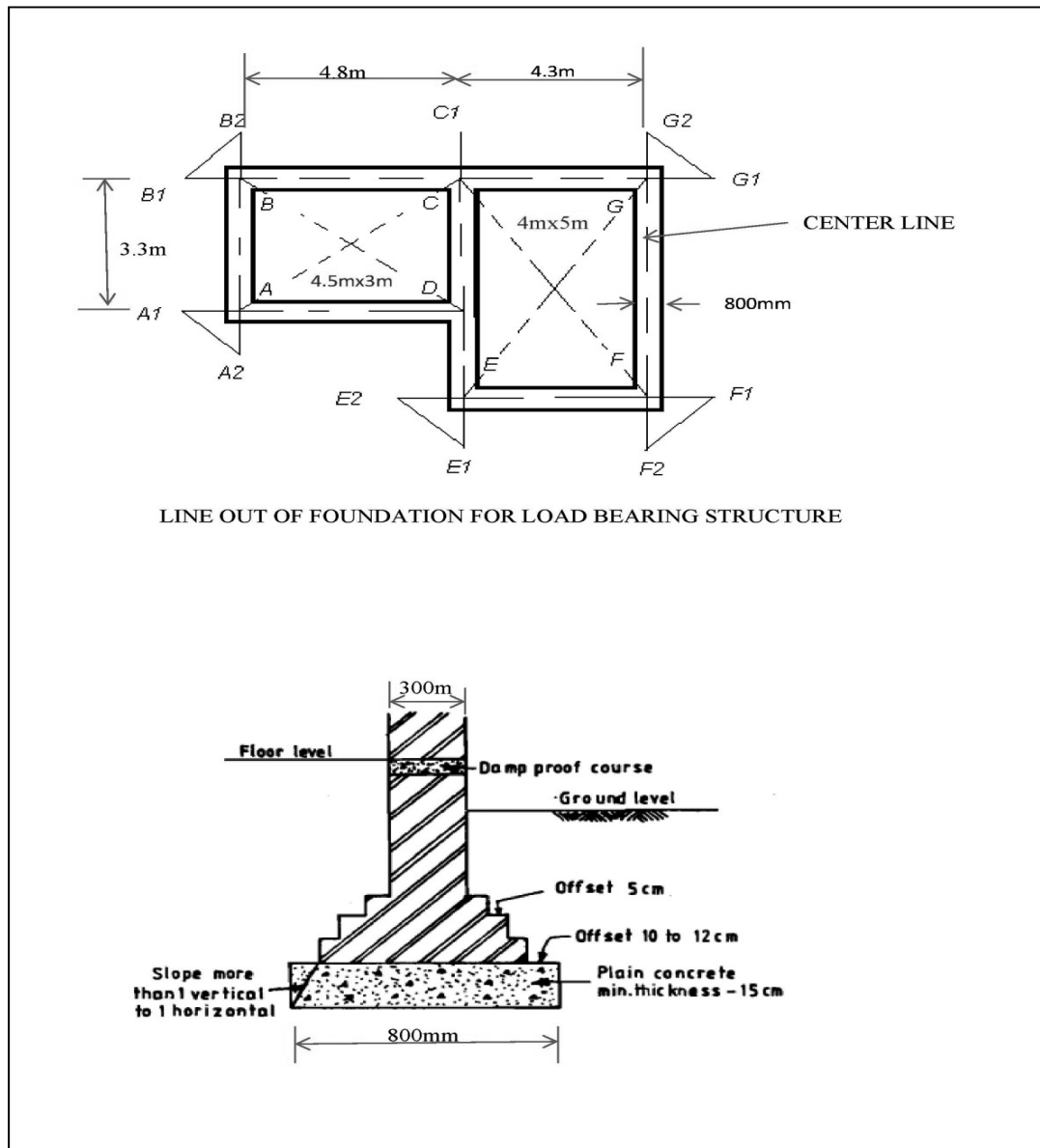


Figure 2: Foundation plan and section

**IX Resources required**

Sr. No.	Particulars	Specification	Quantity	Remark
1	Foundation plan	Drawn on A 4 size sheet with the scale 1: 50 .	1 No	
2	Measuring Tape	30 meter Steel Tape	2 NO	
3	Wooden pegs	25mm X 25 mm X 300 mm wooden peg with pointed at one end	10 No	
4	Line dori(string)	White line dori	2 bundles	
5	Hammer	Hammer of standard size	1 No	
6	Lime powder		Approx. 5 kg	

**X Procedure**

- 1 Prepare the foundation plan and section of wall for the given drawing of the building on the paper to the scale 1:50.
- 2 Mark the positions of the centre lines on foundation plan with reference to a point
- 3 Mark the centre line of the longest outer wall of the building on the ground by stretching a string between wooden pegs driven at its ends. This serves as the reference line for marking the centre line of all the walls of the building.
- 4 The center line of the wall which is perpendicular to this wall is marked by setting up right angle.
- 5 Right angle is set up by forming a triangle with sides 3,4 and 5, units long
- 6 Mark the center line dimension of perpendicular wall on this line.
- 7 Similarly mark the dimensions of all other walls.
- 8 Check the diagonals of all rooms.
- 9 Mark half width of the foundation on both sides of the center line for each wall as per the drawing using lime powder.
- 10 Center lines are then permanently marked by driving the pegs at a distance of at least one meter from external face of excavation.
- 11 After marking the complete layout the position of all the foundation trenches is verified and permission is granted for excavation.
- 12 Thedolite /Total station can be used to verify the layout marked.

**XI Precautions to be followed**

- 1 Correct transformation of the distances on ground from plan.
- 2 Perpendicular should be carefully ensured at corners in particular.

**XII Actual procedure followed (To be written by students)**

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**XIII Resources used**

	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
1					
2					
3					
4					

**XIV Precautions followed**

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**XV Observations** (Use blank sheet provided if space not sufficient)

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 .....

**XVI Results**

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**XVII Interpretation of results**

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 .....  
 .....

**XVIII Conclusions and Recommendations**

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 .....  
 .....

**XIX Practical Related Questions**

*Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO. Write answers of minimum three questions.*

1. Justify the purpose of setting out foundation plan on ground.
2. why the diagonals of individual room /building are plotted on ground.
3. Explain the procedure to measure the right angle of wall with optical square or open cross staff, or Theodolite /Total station.



**XX References / Suggestions for further Reading**

S. No.	Title of Book	Author	Publication
1.	Building Construction	S. P. Arora and S.P.Bindra	Dhanpat Rai Publication, Delhi Edition 2013,ISBN: 9788189928803
2.	A to Z Building Construction	Sandip Mantri	Satya Prakashan; New Delhi (2015) ISBN-13: 978-8176849692

**XXI Suggested Assessment Scheme**

Performance Indicators		Weightage (%)
<b>Process related:15 Marks</b>		<b>60%</b>
1	Drawing of foundation plan on sheet	5%
2	Setting out perpendiculars for center line	20%
3	Check the diagonals	10%
4	Marking the width of foundation	10%
5	Checking the dimensions	10%
6	Working in team.	5%
<b>Product related:10 Marks</b>		<b>40%</b>
1	Setting out correct foundation plan	25%
2	Answers to practical related questions.	10%
3	Submission of report in time.	5%
<b>Total: 25 Marks</b>		<b>100%</b>

**List of Student Team Members**

- 1 .....
- 2 .....
3. ....
- 4.. .....

Marks Obtained			Dated sign of Teacher
Process Related (15)	Product Related (10)	Total (25)	

## **Practical No. 4 & 5: Setting out Foundation Plan for Framed Structure (Part I) and (Part II)**

### **I Practical Significance**

Building Construction is a core subject in Civil Engineering, which deals with the construction processes of sub structure, super structure, building finishes and maintenance of buildings. A diploma civil engineer is required to have the competency of laying down the centre line and mark the foundation plan on the ground before the excavation of foundation trenches. It also requires to maintain the perpendicular at the corners particularly and to verify the same by measuring the diagonals from opposite corners using the Pythagoras principle (i.e.3, 4, 5 method). This practical will develop the aforesaid competency in the graduate.

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

- PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.
- PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.
- PO 4. **Engineering tools:** Apply relevant Civil technologies and tools with an understanding of the limitations.
- PO 8. **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.
- PSO 2. **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### **III Relevant Course Outcomes**

- a. Propose the suitable type of foundation for building structures

### **IV Practical Outcome**

Prepare foundation plan to mark layout on the ground of the framed structure from the given building plan.(Part I)

### **V Competency and Practical Skills**

This practical is expected to develop the following skills for the industry identified competency, “Implement safe building construction practices.”

1. Measurement skill
2. Set out perpendicular on the ground
3. Plot the center line
4. Set the diagonals for proposed building

### **VI Relevant Affective domain related**

- a. Follow safety practices.
- b. Demonstrate working as a leader/a team member.
- c. Maintain tools and equipment.

## VII Minimum Theoretical Background

1. Knowledge of scale
2. Pythagoras principle
3. Foundation plan
4. Skill of transferring the plan on ground.

## VIII Experimental Set-up

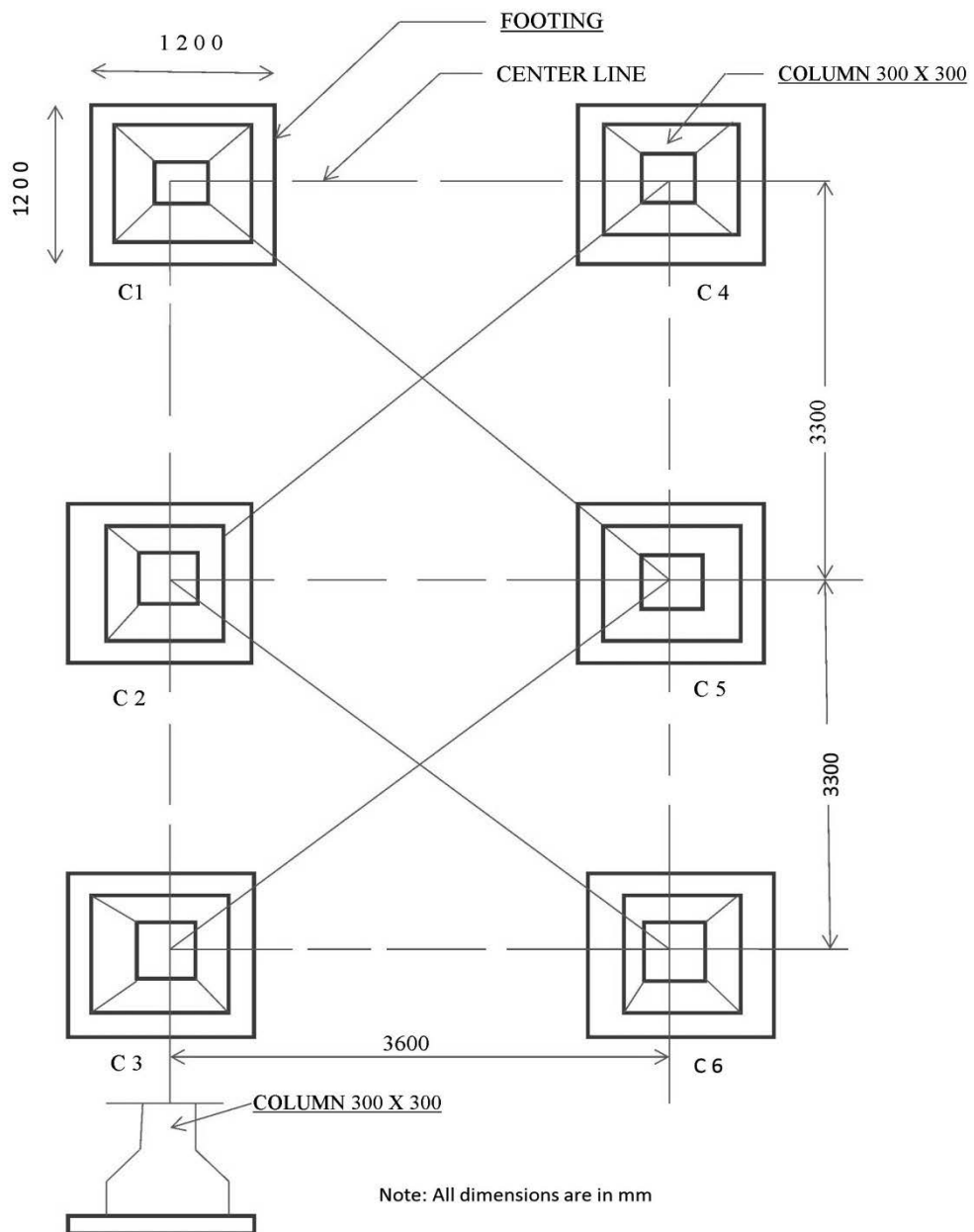


Fig 4a Foundation plan and section

**IX Resources required**

Sr. No.	Particulars	Specification	Quantity	Remark
1	Foundation plan	Drawn on A 4 size sheet with the scale 1: 50.	1 No	
2	Measuring Tape	30 meter Steel Tape	2 NO	
3	Wooden pegs	25mm X 25 mm X 300 mm wooden peg pointed at one end	10 No	
4	Line dori (string)	White line dori	2 bundles	
5	Hammer	Hammer of standard size	1 No	
6	Lime powder	Powder form	Approx. 5 kg	

**X Procedure**

1. Prepare the centre line plan indicating column positions on paper.
2. Boundaries of the plot are fixed from the site plan and final demarcated layout.
3. Mark a parallel line from all sides of the building line at 1.5m away and drive the peg for reference.
4. Drive the guide pegs into the ground at the corners of the building at A,B,C,D.
5. Set up one corner of the building on two adjacent faces. This will be the face line of building
6. Mark centre of corner column e.g.C1 on this line at appropriate distance.
7. From C1, mark position of other centers of column as C2 ,C3,C4,C5 & C6 by Pythagoras theorem (3,4,5 method).
8. Using steel tape measure the distances of each column and fix up the pegs for every centre of column.
9. Repeat the procedure for all columns.
10. A line string is fixed to the pegs for particular column on both axes crossing the point to mark '+' by lime powder.
11. The appropriate width of excavation pit is then marked at the centre of each column by lime powder.
12. Check the diagonals of lay out.
13. Theodolite/Total Station can be used to verify the layout marked.

**XI Precautions to be followed**

- 1 Correct transformation of the distances on ground from plan.
- 2 Perpendicular should be carefully ensured at corners in particular.





**XIIII Precautions followed**

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**XV Observations and Calculations (Use blank sheet provided if space not sufficient)**

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**XVI Results**

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**XVII Interpretation of results**

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**XVIII Conclusions and Recommendations**

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**XIX Practical Related Questions**

*Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO. Write answers of minimum three questions.*

1. Explain the precautions to be taken while marking layout on ground
2. Explain with the help of example the principle of right angle triangle
3. State the necessity of diagonal check

[Space to Write Answers]

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**XX References / Suggestions for further Reading**

S. No.	Title of Book	Author	Publication
1.	Building Construction	S. P. Arora and Bindra	Dhanpat Rai Publication, Delhi Edition 2013, ISBN: 9788189928803
2.	A to Z Building Construction	Sandip Mantri	Satya Prakashan; New Delhi (2015) ISBN-13: 978-8176849692

**XXI Suggested Assessment Scheme**

Performance Indicators		Weightage (%)
<b>Process related:15 Marks</b>		<b>60%</b>
1	Drawing of foundation plan on sheet	5%
2	Setting out perpendiculars for center line	20%
3	Check the diagonals	10%
4	Marking the width of foundation	10%
5	Checking the dimensions	10%
6	Working in team.	5%
<b>Product related:10 Marks</b>		<b>40%</b>
1	Setting out correct foundation plan	25%
2	Answers to practical related questions.	10%
3	Submission of report in time.	5%
<b>Total: 25 Marks</b>		<b>100%</b>

**List of Student Team Members**

1. ....
2. ....
3. ....
4. ....
5. ....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	

## Practical No. 6: One and Half Brick Thick Wall in English Bond

### I Practical Significance

Brick masonry is a process of arranging bricks in courses in order to develop longitudinal and transverse interlocking for individual bricks. The purpose of bonding is to achieve united mass as strong as practicable to suit the length height and thickness of brickwork. The bonds ensure that the vertical joints do not come one over the other. The brick wall having continuous vertical joint will not act as complete unit but will consists of small portion which act as a column. However if a wall is built so that there are no continuous vertical joints the load will get distributed. The various types of bonds generally used in brickwork are header, stretcher, English and Flemish bond.

### II Relevant Program Outcomes (POs)

PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PO 3. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems.

PSO 2. **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### III Relevant Course Outcomes

- a. Select suitable type of masonry for building structures.

### IV Practical Outcome

Assemble one and half Brick thick wall in a English Bond (minimum 3 Course)

### V Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency, “**Implement safe building construction practices**”.

1. Select appropriate material for construction of wall
2. Construct the brick wall in English and Flemish bond
3. Maintain verticality and horizontality of wall

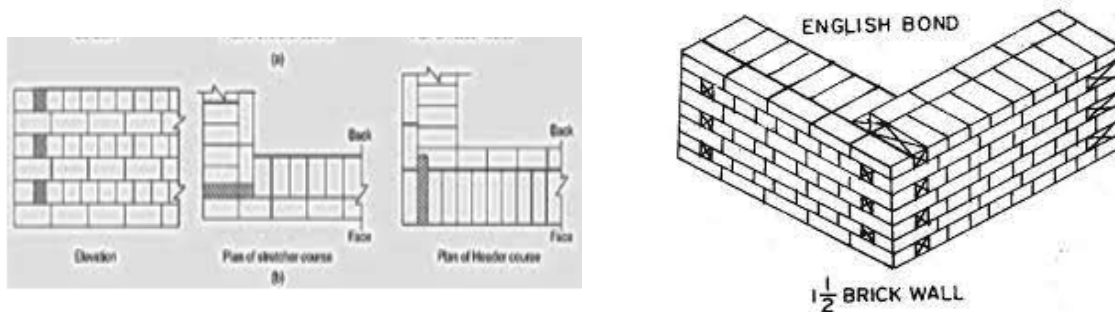
### VI Relevant Affective domain related

- a. Follow safety practices & precautions.
- b. Demonstrate working as a leader/a team member.
- c. Maintain tools and equipment.

**VII Minimum Theoretical Background**

Brick masonry is the arrangement of bricks in successive courses in order to tie brickwork together to achieve maximum strength called bond. It is required to know importance of selection and soaking of bricks. It is required to make use of line string, plumb-bob, and spirit level to maintain verticality and horizontality in the construction of brick wall in English bond. This bond is produced by laying alternate courses of headers and stretchers. For breaking joints vertically it is essential to place queen closer after the header quoin in the heading course.

**VIII Experimental Set up**



**Figure : Plan and Elevation of alternate courses of one and half brick thick wall in English bond**

**IX Resources required**

Sr. No.	Particulars	Specification	Quantity	Remark
1	Trowel (Thapi)	Medium type 15 cm long	10	
2	Line string/dori	1 to 2 mm diameter	50m	
3	Plumb-bob	Mild steel	2 no.	
4	Water tube level	5mm diameter plastic tube	10m	
5	Mason spirit level	30 cm long with vertical and horizontal bubble	5 no.	
6	Mason square	60cm long leg & 20cm short leg	5 no.	
7	Measuring tape	Metallic tape 30m & steel tape 30m	5no.	
8	Spade	20 cm wide MS blade	5 no.	
9	Mortar pan	Plastic or iron	10 no.	
10	Bricks	IS or local bricks of size 19x9x9cm	1000 no	
11	Cement	OPC	5 bags	
12	Sand	River fine sand	5cum	

**X Procedure**

1. All the bricks to be used are thoroughly soaked in water so that they do not absorb water from mortar.
2. Prepare mortar with proportion CM 1:6.
3. Spread the mortar over the area to be covered with the thickness of 15mm.
4. First construct the corner of the wall. Lay one brick at the corner and press it with hands so that the thickness of the bed joint remains only about 10mm.
5. The first queen closure is also fixed as corner brick. Check the level and alignment. Lay other bricks to form thickness of one and half brick thick wall .
6. After laying first course spread the mortar over entire course and arrange the bricks to get bond.
7. Similarly lay down the corner at another end of wall .The corner construction will guide for filling between bricks of various courses
8. Stretch the line string along top of the first course laid at each corner of wall .The course is then raised. The line string is then shifted up and second course is constructed .This process is repeated for consecutive courses
9. The verticality and horizontality is checked by plumb bob and spirit level for every course.
10. The joints should be cleaned after everyday's work.

**XI Precautions to be followed**

1. Never start header course with queen closer.
2. Every alternate header comes centrally over the joint between the two stretcher in the course below giving a lap of one-fourth brick .
3. Check the verticality of a wall with plumb bob after every course.

**XII Actual procedure followed**

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**XIII Resources used**

	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
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3					
4					

**XIV Precautions followed**

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**XV Observations** (Use blank sheet provided if space not sufficient)

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**XVI Results**

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**XVII Interpretation of results**

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**XVIII Conclusions and Recommendations**

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**XIX Practical Related Questions**

*Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO. Write answers of minimum three questions.*

- 1 Suggest suitable type of bond for compound wall and partition wall.
- 2 Explain the method to break the continuity of vertical joint
- 3 State the function of line string, plumb bob, masons square, level tube.





**XX References / Suggestions for further Reading**

S. No.	Title of Book	Author	Publication
1.	Building Construction	S. P. Arora and S.P.Bindra	Dhanpat Rai Publication, Delhi Edition 2013,ISBN: 9788189928803
2.	A to Z Building Construction	Sandip Mantri	Satya Prakashan; New Delhi (2015) ISBN-13: 978-8176849692

**XXI Suggested Assessment Scheme**

Performance Indicators		Weightage (%)
<b>Process related:15 Marks</b>		<b>60%</b>
1	Laying bricks in line with frog upward	15%
2	Use of Queen closer appropriately	10%
3	Placing the mortar in joints	10%
4	Checking the verticality of wall by plumb bob	10%
5	Checking the right angle with mason's square	10%
6	Working in team.	5%
<b>Product related:10 Marks</b>		<b>40%</b>
1	Construction of wall in 3 courses	25%
2	Answers to practical related questions.	10%
3	Submission of report in time.	5%
<b>Total: 25 Marks</b>		<b>100%</b>

**List of Student Team Members**

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	

## **Practical No. 7: One and Half Brick Thick Wall in Flemish Bond**

### **I Practical Significance**

Brick masonry is a process of arranging bricks in courses in order to develop longitudinal and transverse interlocking for individual bricks. The purpose of bonding is to achieve united mass as strong as practicable to suit the length height and thickness of brickwork. The bonds ensure that the vertical joints do not come one over the other. The brick wall having continuous vertical joint will not act as complete unit but will consists of small portion which act as a column. However if a wall is built so that there are no continuous vertical joints the load will get distributed. The various types of bonds generally used in brickwork are header, stretcher, English and Flemish bond.

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

PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PO 3. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems.

PSO 2. **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### **III Relevant Course Outcomes**

a. Select suitable type of masonry for building structures.

### **IV Practical Outcome**

Assemble one and half Brick thick wall in a Flemish Bond (minimum 3 Course)

### **V Competency and Practical Skills**

This practical is expected to develop the following skills for the industry identified competency, “Implement safe building construction practices”.

1. Select appropriate material for construction of wall
2. Construct the brick wall in English and Flemish bond
3. Maintain verticality and horizontality of wall

### **VI Relevant Affective domain related**

- a. Follow safety practices & precautions.
- b. Demonstrate working as a leader/a team member.
- c. Maintain tools and equipment.

## VII Minimum Theoretical Background

Brick masonry is the arrangement of bricks in successive courses in order to tie brickwork together to achieve maximum strength called bond. It is required to know importance of selection and soaking of bricks. It is required to make use of line string, plumb-bob, and spirit level to maintain verticality and horizontality in the construction of brick wall in English bond. This bond is produced by laying alternate courses of headers and stretchers. For breaking joints vertically it is essential to place queen closer after the header quoin in the heading course.

## VIII Experimental Set up

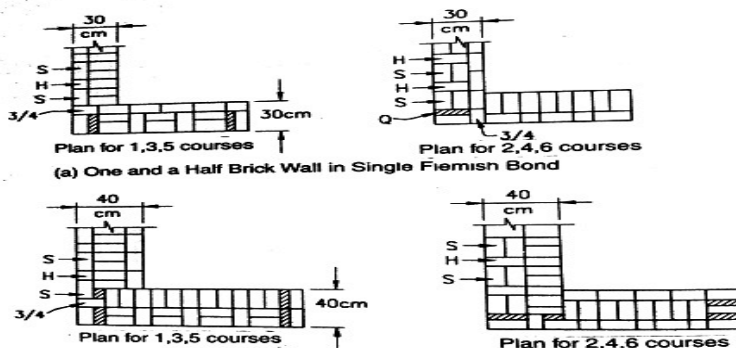


Figure 7: Plan of one and half brick thick and two brick thick wall in Flemish bond

## IX Resources required

Sr. No.	Particulars	Specification	Quantity	Remark
1	Trowel (Thapi)	Medium type 15 cm long	10	
2	Line string/dori	1 to 2 mm diameter	50m	
3	Plumb-bob	Mild steel	2 no.	
4	Water tube level	5mm diameter plastic tube	10m	
5	Mason spirit level	30 cm long with vertical and horizontal bubble	5 no.	
6	Mason square	60cm long leg & 20cm short leg	5 no.	
7	Measuring tape	Metallic tape 30m & steel tape 30m	5no.	
8	Spade	20 cm wide MS blade	5 no.	
9	Mortar pan	Plastic or iron	10 no.	
10	Bricks	IS or local bricks of size 19x9x9cm	1000 no	
11	Cement	OPC	5 bags	
12	Sand	River fine sand	5cum	

**X Procedure**

1. All the bricks to be used are thoroughly soaked in water so that they do not absorb water from mortar.
2. Prepare mortar with proportion CM 1:6.
3. Spread the mortar over the area to be covered with the thickness of 15mm.
4. First construct the corner of the wall. Lay one brick at the corner and press it with hands so that the thickness of the bed joint remains only about 10mm.
5. The first queen closure is also fixed as corner brick. Check the level and alignment. Lay three fourth brick adjacent to it. Lay two bricks perpendicular to each other to form one and half brick thick wall
6. After laying first course spread the mortar over entire course and arrange the bricks to get bond.
7. Similarly lay down the corner at another end of wall .The corner construction will guide for filling between bricks of various courses
8. Stretch the line string along top of the first course laid at each corner of wall .The course is then raised. The line string is then shifted up and second course is constructed .This process is repeated for consecutive courses
9. The verticality and horizontality is checked by plumb bob and spirit level for every course.
10. The joints should be cleaned after everyday's work.

**XI Precautions to be followed**

1. Never start header course with queen closer.
2. Every alternate header comes centrally over the joint between the two stretcher in the course below giving a lap of one-fourth brick .
3. Check the verticality of a wall with plumb bob after every course.

**XII Actual procedure followed (To be written by students)**

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**XIII Resources used**

	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
1					
2					
3					
4					

**XIV Precautions followed**

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**XV Observations** (Use blank sheet provided if space not sufficient)

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**XVI Results**

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**XVII Interpretation of results**

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**XVIII Conclusions and Recommendations**

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**XIX Practical Related Questions**

*Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO. Write answers of minimum three questions.*

- i) State the significance of bond in brick work
- ii) Explain with sketch difference between English bond and Flemish bond.
- iii) Draw neat sketches of plans of alternate courses for two brick thick wall in Flemish bond.



**XX References / Suggestions for further Reading**

S. No.	Title of Book	Author	Publication
1.	Building Construction	S. P. Arora and S.P.Bindra	Dhanpat Rai Publication, Delhi Edition 2013,ISBN: 9788189928803
2.	A to Z Building Construction	Sandip Mantri	Satya Prakashan; New Delhi (2015) ISBN-13: 978-8176849692

**XXI Suggested Assessment Scheme**

Performance Indicators		Weightage (%)
<b>Process related:15 Marks</b>		<b>60%</b>
1	Laying bricks in line with frog upward	15%
2	Use of Queen closer and three fourth bat appropriately	10%
3	Placing the mortar in joints	10%
4	Checking the verticality of wall by plumb bob	10%
5	Checking the right angle with mason's square	10%
6	Working in team.	5%
<b>Product related:10 Marks</b>		<b>40%</b>
1	Construction of wall in 3 courses	25%
2	Answers to practical related questions.	10%
3	Submission of report in time.	5%
<b>Total: 25 Marks</b>		<b>100%</b>

**List of Student Team Members**

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- 2.....
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- 4.....
- 5.....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	



## Practical No. 8: Stone Masonry Construction Work

### I Practical Significance

Stone masonry is an art of building structure in stones. In some parts of the country building stones are abundantly available in nature. These stones when cut and dressed to the proper shapes provide an economical material for the construction of various components of building which are located in hilly areas.

### II Relevant Program Outcomes (POs)

PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PO 3. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Civil engineering problems.

PSO 2. **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### III Relevant Course Outcomes

a. Select suitable type of masonry for building structures.

### IV Practical Outcome

Prepare a simple stone masonry construction work

### V Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency, “Implement safe building construction practices”.

1. Select appropriate material for construction of wall
2. Construct the stone masonry
3. Maintain verticality and horizontality of masonry

### VI Relevant Affective domain related

- a. Follow safety practices & precautions.
- b. Demonstrate working as a leader/a team member.
- c. Maintain tools and equipment.

### VII Minimum Theoretical Background

1. Important terms used in stone masonry
2. Uses of stone masonry
3. Selection of stone for stone masonry
4. Tools and equipments for stone masonry
5. Classification of stone masonry.
6. General principles in stone masonry construction

## VIII Experimental Set-up

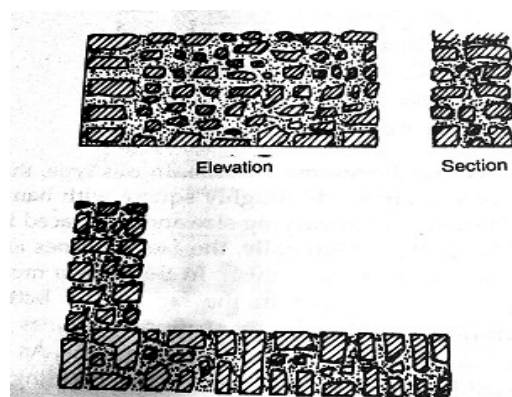


Figure 8: Plan and elevation of course random rubble stone masonry

## IX Resources required

Sr. No.	Particulars	Specification	Quantity	Remark
1	Trowel (Thapi)	Medium type 15 cm long	10	
2	Line string/dori	1 to 2 mm diameter	50m	
3	Plumb-bob	Mild steel	2 no.	
4	Water tube level	5mm diameter plastic tube	10m	
5	Mason spirit level	30 cm long with vertical and horizontal bubble	5 no.	
6	Mason square	60cm long leg & 20cm short leg	5 no.	
7	Measuring tape	Metallic tape 30m & steel tape 30m	5no.	
8	Spade	20 cm wide MS blade	5 no.	
9	Mortar pan	Plastic or iron	10 no.	
10	stones	Well dressed	1000 no	
11	Cement	OPC	5 bags	
12	Sand	River fine sand	5cum	

## X Procedure

1. Prepare mortar with proportion CM 1:6.
2. Spread the mortar over the area to be covered with the thickness of 30 mm.
3. First construct the corner of the wall. Lay quoine at the corner and press it with hands so that the thickness of the bed joint remains only about 10 mm.
4. Put the other stone in sequence from both sides. Check the level and alignment.
5. After laying first course pack the hearting properly with mortar and chips
6. Similarly lay down the corner at another end of wall .The corner construction will guide for filling between stones of various courses

7. Stretch the line string along top of the first course laid at each corner of wall .The course is then raised. The line string is then shifted up and second course is constructed .This process is repeated for consecutive courses
8. The verticality and horizontality is checked by plumb bob and spirit level for every course.
9. The joints should be cleaned after every day’s work

**XI Precautions to be followed**

1. Base of the stone should be flat.
2. Stone should be well dressed
3. Face of the stone shall be smooth
4. Handle the tools carefully

**XII Actual procedure followed** (Use blank sheet provided if space not sufficient)

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**XIII Resources used**

	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
1					
2					
3					
4					

**XIV Precautions followed**

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**XV Observations** (Use blank sheet provided if space not sufficient)

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**XVI Results**

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S. No.	Title of Book	Author	Publication
3	PWD Handbooks for Materials, Masonry, Building, Plastering and Pointing - Foundation	Public Works Department	Public Works Department
4	Practical Civil Engineering Handbook	Khanna	Khanna Publication

### XXI Suggested Assessment Scheme

Performance Indicators		Weightage (%)
<b>Process related:15 Marks</b>		<b>60%</b>
1	Placing the stone correctly on its base	5%
2	Use of quoin at the corner	10%
3	Packing the mortar and chips in hearting	20%
4	Checking the verticality of wall by plumb bob	10%
5	Checking the right angle with mason's square	10%
6	Working in team.	5%
<b>Product related:10 Marks</b>		<b>40%</b>
1	Construction of stone masonry in line and plumb in 3 courses	25%
2	Answers to practical related questions.	10%
3	Submission of report in time.	05%
<b>Total: 25 Marks</b>		<b>100%</b>

#### List of Student Team Members

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	

## **Practical No. 9 & 10: Scaffolding, Formwork and Centering Work. (Part I) & (Part II)**

### **I Practical Significance**

Temporary supporting structures are required in building construction either for supporting the laying of concrete or for supporting the material or labour for execution of construction work. The scaffolding is a temporary structure used in building operation to support platforms for work men required during construction at raised height more than 1.5 meter. The temporary mould used to place the concrete to form components like beams, lintels, and sun shades is known as Formwork. Temporary supports for Placing concrete to construct roof slab is called as Centering.

### **II Relevant Program Outcomes (POs) (from programme Structure)**

PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PO 9. **Communication:** Communicate effectively in oral and written form.

PSO 2. **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### **III Relevant Course Outcomes**

a. Select suitable type of scaffolding, formwork and centering for building structures.

### **IV Practical Outcome**

Prepare a report on visit to construction site with respect to scaffolding, formwork and centering work.(Part I) & (Part II)

### **V Competency and Practical Skills**

This practical is expected to develop the following skills for the industry identified competency, “Implement safe building construction practices”.

1. Select the materials for scaffolding, formwork and centering.
2. Select relevant scaffolding for work.
3. Erect the scaffolding, formwork and centering.
4. Check the level of scaffolding, formwork and centering.

### **VI Relevant Affective domain related**

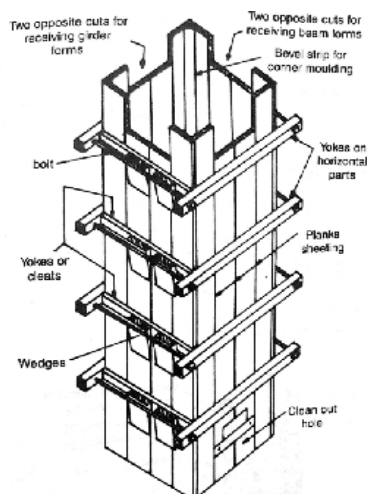
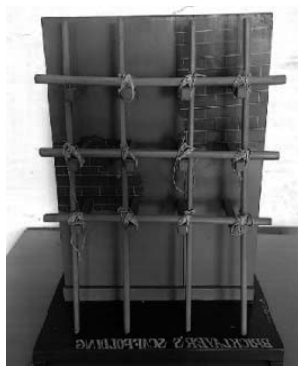
- a. Follow safety practices.
- b. Practice good housekeeping.
- c. Demonstrate working as a leader/a team member.

### **VII Minimum Theoretical Background**

1. Component parts of scaffolding
2. Types of scaffolding
3. Requirement of good formwork
4. Material for formwork

5. Types of formwork
6. Material for centering
7. Component parts of centering

### VIII Experimental Set-up



**Figure 9: Scaffolding and Formwork**

### IX Field Visit Report

Date of Visit:	
Project: Project Name	
Site Address:	
Contractor: Contractor Name	
Architect :	
Structural Consultant -	
Project Risk Manager: Name	
Phone:	
Email:	
Reason for choosing the site –	
Date of Start of project -	
Status of Project- Completed/Ongoing,	Date of completion, if applicable -
Monitored by : Name(s) and position:	



**X Methodologies used: (You may write other than the following)**

Name of equipments and machineries present on Site	The activity for which it is being used

**XI Precautions to be followed**

1. Maintain discipline during visit
2. Use safety measures on site
3. Listen and follow the instructions given by site In-charge

**XII Observations at Site: (Use blank sheet provided if space not sufficient)**

1. Type of structure  
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2. Type of scaffolding  
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3. Component parts of scaffolding  
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4. Material used for scaffolding-  
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5. Purpose of scaffolding  
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6. Attach photograph of scaffolding

7. Type of formwork(column/beam)

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8. Component parts of formwork

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9. Material used for formwork-

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10. Purpose of formwork

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11. Attach photograph of formwork

12. Component parts of centering

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13. Material used for centering-

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14. Purpose of centering

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15. Attach photograph of centering

**XIII Resources used**

Sr. No.	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
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4					

**XIV Precautions followed**

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**XV Observations** (Use blank sheet provided if space not sufficient)

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**XVI Results**

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**XVII Interpretation of results**

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**XVIII Conclusions and Recommendations**

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**XIX Practical Related Questions**

*Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO. Write answers of minimum three questions.*

1. Explain the following terms  
a) Formwork    b) Scaffolding    c) Centering
2. Write the requirements of good formwork.
3. List the causes of failure of form work.
4. Draw the neat sketch of scaffolding and label the component parts.
5. Write the suitability of following
  - a) Single scaffolding
  - b) Double scaffolding
  - c) Cantilever Scaffolding
  - d) Suspended Scaffolding

(Space to Write Answers)

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**XXI Suggested Assessment Scheme**

<b>Performance Indicators</b>		<b>Weightage (%)</b>
<b>Process related:15 Marks</b>		<b>60%</b>
1	Report writing	25%
2	Understanding of components	25%
3	Working in team.	10%
<b>Product related:10 Marks</b>		<b>40%</b>
1	Answers to practical related questions.	30%
2	Submission of report in time.	10%
<b>Total: 25 Marks</b>		<b>100%</b>

***List of Student Team Members***

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

<b>Marks Obtained</b>			<b>Dated signature of Teacher</b>
<b>Process Related(15)</b>	<b>Product Related(10)</b>	<b>Total (25)</b>	

## Practical No. 11: Components of Staircase

### I Practical Significance

A successful functioning of multi-storey building requires circulation in normal use and in emergencies. The means of vertical communication between various floors are staircase, ramp, lift, ladders and escalators. The stairs should be thoughtfully located, carefully planned, and tastefully designed for serving its purpose and being economically in construction. A stair is a series of steps arranged in such a manner as to connect different floors of a building.

### II Relevant Program Outcomes (POs)

PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PSO 2. **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### III Relevant Course Outcomes

a. Propose relevant means of communications for different types of buildings.

### IV Practical Outcome

Identify various components of staircase in the given model

### V Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency.

1. Propose relevant means of communications for different types of buildings.
2. Select the staircase on the basis of utility
3. Draw plan, sectional elevation of a staircase

### VI Relevant Affective domain related

a. Handle the model carefully.

### VII Minimum Theoretical Background

Technical terms used for design of staircase

1. Step- This is a portion of stair which is comprised of tread and rise
2. Tread- It is an upper horizontal part of a step on which foot is placed in ascending or descending a stairway
3. Rise- This is vertical distance between the upper faces of any two consecutive steps
4. Landing- This is a platform provided between two flights
5. Nosing- This is outer projecting edge of a tread
6. Requirements of good staircase- Stair should be easily accessible. It should have adequate light and proper ventilation. Number of steps should be restricted to maximum of 12 and minimum 3. Vertical clearance of head room should not be less than 2.15 meter. Minimum width of tread should be 250 millimeter and height of riser should be 175 to 185 millimeter. Product of riser and tread must be between 400 to



410. Rise plus tread must be equal to 42.5 to 43.5 cm. Sum of tread and twice the riser must be between 60cm. to 64cm.

### VIII Experimental Set-up

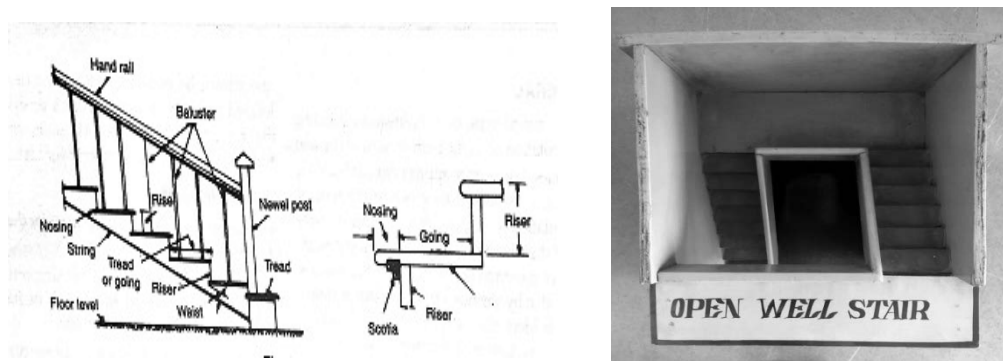


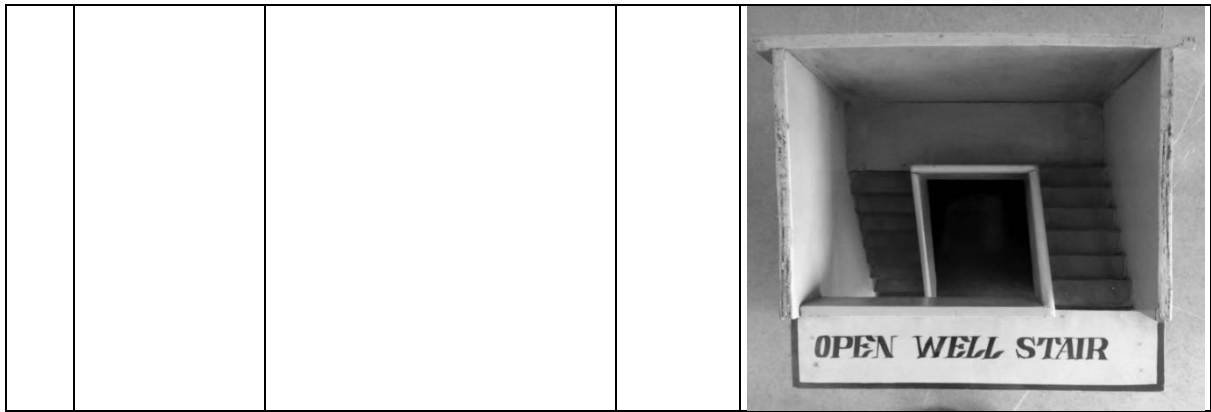


Figure 11: Components of staircase

### IX Resources required

Sr. No.	Particulars	Specification	Quantity	Remark (Photos)
1	Model of Staircase	Model showing all component parts of staircase	1	
2	Model of staircase	Models showing types of staircase	1	



**X Procedure:-**

1. Conduct the visit to model room or actual site.
2. Identify type of stair.
3. Identify the components of stair.
4. Draw a neat sketch of stair model (plan and elevation) showing all component parts.

**XI Precautions to be followed**

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**XII Actual procedure followed**

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**XIII Resources used**

Sr. No.	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
1					
2					

**XIV Precautions followed**

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**XV Observations and Calculations** (Use blank sheet provided if space not sufficient)

Sr. No.	Type of Staircase(Model)	Specifications

**XVI Results**

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**XXI Suggested Assessment Scheme**

<b>Performance Indicators</b>		<b>Weightage (%)</b>
<b>Process related:15 Marks</b>		<b>60%</b>
1	Identifying the type of staircase.	5%
2	Identifying the component parts of staircase.	20%
3	Design staircase with proper size of tread and rise.	20%
4	Applying good requirement of staircase to design it .	10%
5	Working in team.	5%
<b>Product related:10 Marks</b>		<b>40%</b>
1	Answers to practical related questions.	30%
2	Submission of report in time.	10%
<b>Total: 25 Marks</b>		<b>100%</b>

***List of Student Team Members***

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

<b>Marks Obtained</b>			<b>Dated signature of Teacher</b>
<b>Process Related(15)</b>	<b>Product Related(10)</b>	<b>Total (25)</b>	

## Practical No. 12: Components of Doors and Windows

### I Practical Significance

Door is a movable barrier secured in an opening. It is held in position by a door frame. The main function of doors in a building is to serve a connecting link between internal parts and also allow the free movement into and outside the building. Windows are provided for proper ventilation and light. Their size and number should be properly determined as per the requirement.

### II Relevant Program Outcomes (POs)

PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PSO 2. **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### III Relevant Course Outcomes

(a) Propose relevant means of communications for different types of buildings.

### IV Practical Outcome

Identify various components of doors and windows from the model to prepare the report with sketches.

### V Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency, “Implement safe building construction practices”.

1. Locate the position of Door and Window

### VI Relevant Affective domain related

a. Handle the model carefully.

### VII Minimum Theoretical Background

1. Technical terms used in connection with door and windows such as shutter, frame, head, horn, sill, holdfast, jamb, reveal, rebate, style, rail, mullion, transom, sash

2. Types of doors with their sizes

3. Types of windows with their sizes

### VIII Experimental Set-up

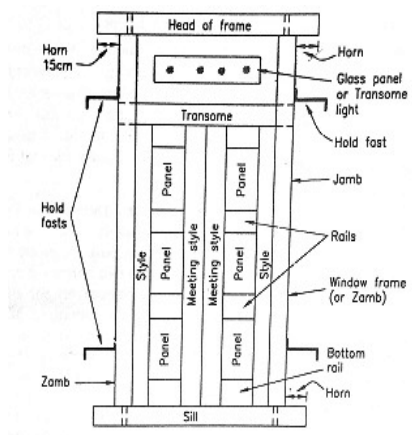




Figure 12: Component parts of door and window

### IX Resources required

Sr. No.	Particulars	Specification	Quantity	Remark (Photos)
1	Model of door	Model showing all component parts of door	1	
2	Model of window	Model showing all component parts of window	1	



3	Model of types of door	Models showing all types of doors	
4	Model of types of windows	Models showing all types of windows	

**X Procedure:-**

1. Conduct the visit to model room or actual site.
2. Identify the types of doors
3. Identify the types of the windows
4. Identify component parts of doors
5. Identify component parts of windows
6. Describe function of each component

**XI Precautions to be followed**

- a. Handle the model carefully

**XII Actual procedure followed**

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**XIII Resources used**

Sr. No.	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
1					
2					

**XIV Precautions followed**

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**XV Observations**

Sr. No.	Type of door/window(Model)	Specifications

**XVI Results**

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**XVII Interpretation of results**

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**XXI Suggested Assessment Scheme**

<b>Performance Indicators</b>		<b>Weightage (%)</b>
<b>Process related:15 Marks</b>		<b>60%</b>
1	Identifying the types of doors and windows	5%
2	Identifying the component parts of doors and windows	20%
3	Identifying fixtures and fastenings	20%
4	Selecting proper type of door or window	10%
6	Working in team.	5%
<b>Product related:10 Marks</b>		<b>40%</b>
1	Answers to practical related questions.	30%
2	Submission of report in time.	10%
<b>Total: 25 Marks</b>		<b>100%</b>

***List of Student Team Members***

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

<b>Marks Obtained</b>			<b>Dated signature of Teacher</b>
<b>Process Related(15)</b>	<b>Product Related(10)</b>	<b>Total (25)</b>	

## **Practical No. 13: Types of Flooring and Roofing Materials (Part I)**

### **I Practical Significance**

Floors are horizontal elements of a building structure which divide the building into different levels for the purpose of creating more accommodation within a restricted space. Flooring is meant to provide hard, clean, smooth, impervious, durable, and attractive surface to the floor. A roof is a uppermost part of the building which is supported on structural members and covered with roofing materials. Roof covering is a material covering provided over the form work of roof structure.

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

PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PSO 2. **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### **III Relevant Course Outcomes**

- a. Select the relevant material for finishing works.

### **IV Practical Outcome**

Identify various types of flooring and roofing materials in the lab to prepare report.( part I)

### **V Competency and Practical Skills**

This practical is expected to develop the following skills for the industry identified competency, “Implement safe building construction practices”.

1. Execute the process of flooring and roofing
2. Identify defects in flooring, roofing ,plastering and suggest remedial measures

### **VI Relevant Affective domain related**

- a) Handle the material carefully.

### **VII Minimum Theoretical Background**

1. Selection of type of flooring according to type of building.
2. Method of construction of flooring
3. Different materials used for flooring
4. Selection of type of roofing material
5. Method of construction of laying roofing material.

**VIII Experimental Set-up**



**Figure 13: Types of Flooring**

**IX Resources required**

Sr. No.	Particulars	Specification	Quantity	Remark (Photos)
1	Different types of flooring material	Concrete flooring	1	
2		Mud flooring	1	
3		Wooden flooring	1	
4		Terrazzo flooring	1	

**X Procedure:-**

- 1) Conduct the visit to model room or actual site.
- 2) Identify the different types of flooring material.
- 3) Identify the different types of roofing material.
- 4) Find the application of each based on type of building

**XI Precautions to be followed**

- a. Handle the material carefully

**XII Actual procedure followed**

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**XIII Resources used**

Sr. No.	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
1					
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3					
4					

**XIV Precautions followed**

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**XV Observations and Calculations (Use blank sheet provided if space not sufficient)**

Sr. No.	Flooring material and type used	Detail Specification




**XVI Results**

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**XVII Interpretation of results**

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**XVIII Conclusions and Recommendations**

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**XIX Practical Related Questions**

*Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO. Write answers of minimum three questions.*

- 1) Mention the various factors that should be considered for the selection of type of flooring
- 2) Explain procedure of laying of terrazzo tiles.
- 3) Give reason with justification : Use of timber flooring in auditoriums

(Space to Write Answers)

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**XXI Suggested Assessment Scheme**

<b>Performance Indicators</b>		<b>Weightage (%)</b>
<b>Process related:15 Marks</b>		<b>60%</b>
1	Identifying flooring material	25%
2	Selection of flooring material as per requirement	25%
3	Working in team.	10%
<b>Product related:10 Marks</b>		<b>40%</b>
1	Answers to practical related questions.	30%
2	Submission of report in time.	10%
<b>Total: 25 Marks</b>		<b>100%</b>

***List of Student Team Members***

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

<b>Marks Obtained</b>			<b>Dated signature of Teacher</b>
<b>Process Related(15)</b>	<b>Product Related(10)</b>	<b>Total (25)</b>	

## **Practical No. 14: Types of Flooring and Roofing Materials (Part II )**

### **I Practical Significance**

Floors are horizontal elements of a building structure which divide the building into different levels for the purpose of creating more accommodation within a restricted space. Floor covering is meant to provide hard, clean, smooth, impervious, durable, and attractive surface to the floor. A roof is a uppermost part of the building which is supported on structural members and covered with roofing materials. Roof covering is a material covering provided over the form work of roof structure.

### **.II Relevant Program Outcomes (POs)**

PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PSO 2. **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### **III Relevant Course Outcomes**

- a. Select the relevant material for finishing works.

### **IV Practical Outcome**

Identify various types of flooring and roofing materials in the lab to prepare report.(Part II )

### **V Competency and Practical Skills**

This practical is expected to develop the following skills for the industry identified competency, “Implement safe building construction practices”.

- 1) Execute the process of flooring and roofing
- 2) Identify defects in flooring, roofing ,plastering and suggest remedial measures

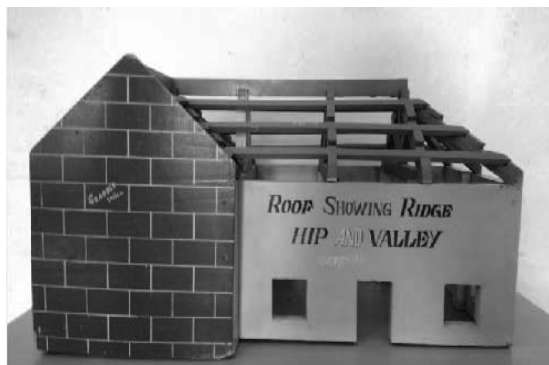
### **VI Relevant Affective domain related**

- a) Handle the material carefully.



### **VII Minimum Theoretical Background**

1. Selection of type of roofing according to type of building.
2. Selection of type of roofing material
3. Method of construction of laying roofing material.

**VIII Experimental Set-up:**



**IX Resources required**

Sr. No.	Particulars	Specification	Quantity	Remark (Photos)
1	Different types of roofing material	Types of roofs and roofing sheets	05	
2	Different types of roof covering material	Types of roofing material	05	

**X Procedure:-**

- 1) Conduct the visit to model room or actual site.
- 2) Identify the different types of flooring material.
- 3) Identify the different types of roofing material.
- 4) Find the application of each based on type of building

**XI Precautions to be followed**

- a. Handle material carefully

**XII Actual procedure followed**

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**XIII Resources used**

Sr. No.	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
1					
2					

**XIV Precautions followed**

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**XV Observations and Calculations (Use blank sheet provided if space not sufficient)**

Sr. No.	Roofing material and type	Detail Specification

**XVI Results**

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**XVII Interpretation of results**

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**XVIII Conclusions and Recommendations**

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**XIX Practical Related Questions**

*Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO. Write answers of minimum three questions*

1. Mention the various factors that should be considered for the selection of type of roofing material.
2. Describe the construction procedure of R.C.C. flat roof.
3. Describe with neat sketch the method of laying and fixing roof covering for pitched roof

[Space to Write Answers]

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**XXI Suggested Assessment Scheme**

<b>Performance Indicators</b>		<b>Weightage (%)</b>
<b>Process related:15 Marks</b>		<b>60%</b>
1	Identifying roofing material	25%
2	Selection of roofing material as per requirement	25%
3	Working in team.	10%
<b>Product related:10 Marks</b>		<b>40%</b>
1	Answers to practical related questions.	30%
5	Submission of report in time.	10%
<b>Total: 25 Marks</b>		<b>100%</b>

***List of Student Team Members***

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

<b>Marks Obtained</b>			<b>Dated signature of Teacher</b>
<b>Process Related(15)</b>	<b>Product Related(10)</b>	<b>Total (25)</b>	

## **Practical No. 15: Visit to Construction Site for Plastering and Pointing Work**

### **I Practical Significance**

Plastering is the process of covering rough surfaces of walls, columns, ceilings, etc. with a coat of mortar. The term plastering holds good for both internal and external surfaces of the building. Pointing is the term used for finishing of mortar joints so as to make them water tight and aesthetically good. The function is to protect and preserve the material used for building components also they provide a decorative effect.

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

PO 1- **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO 2- **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PO 9 - **Communication:** Communicate effectively in oral and written form.

PSO 2 – **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### **III Relevant Course Outcomes**

a. Select the relevant material for finishing works.

### **IV Practical Outcome**

Record the observation of plastering and pointing work at construction site to prepare a report

### **V Competency and Practical Skills**

This practical is expected to develop the following skills for the industry identified competency, “Implement safe building construction practices”.

1. Apply relevant methods of plastering.
2. Inspect Surface evenness using plumb bob.
3. Identify defects in plastering and suggest remedial measures.
4. Select the relevant material for finishing works.

### **VI Relevant Affective domain related**

1. Follow safety practices.
2. Practice good housekeeping.
3. Demonstrate working as a leader/a team member.

### **VII Minimum Theoretical Background**

1. Objectives of plastering
2. Technical terms used in plastering and pointing
3. Types of plastering and pointing
4. Requirements of good plaster
5. Tools used in plastering
6. Method of plastering and pointing

### VIII Experimental Set-up



**Figure15: Plastering**

### IX Field Visit Report

Date of Visit:	
Project: Project Name	
Site Address:	
Contractor: Contractor Name	
Architect :	
Structural Consultant -	
Project Risk Manager: Name	
Phone:	
Email:	
Reason for choosing the site –	
Date of Start of project -	
Status of Project- Completed/Ongoing,	Date of completion, if applicable -
Monitored by : Name(s) and position:	

**X Methodologies used: (You may write other than the following)**

Name of tools present on Site	The activity for which it is being used

**XI Precautions to be followed**

1. Maintain discipline during visit
2. Use safety measures on site
3. Listen and follow the instructions given by site In-charge

**XII Observations at Site: (Use blank sheet provided if space not sufficient)**

1. Type of structure

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2. Type of plastering

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3. Material and its proportion used for plastering

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4. Procedure of plastering

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5. Attach photograph of scaffolding

6. Type of structure

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7. Type of pointing

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8. Material and its proportion used for pointing

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9. Procedure of pointing

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10. Attach photograph of pointing

**XIII Resources used**

Sr. No.	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
1					
2					
3					
4					

**XIV Precautions followed**

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**XV Observations** (Use blank sheet provided if space not sufficient)

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**XVI Results**

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**XVII Interpretation of results**

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**XX References / Suggestions for further Reading**

S. No.	Title of Book	Author	Publication
1.	Building Construction	S. P. Arora and Bindra	Dhanpat Rai Publication, Delhi Edition 2013, ISBN: 9788189928803
2.	A to Z Building Construction	Sandip Mantri	Satya Prakashan; New Delhi (2015) ISBN-13: 978-8176849692

**XXI Suggested Assessment Scheme**

Performance Indicators		Weightage (%)
<b>Process related:15 Marks</b>		<b>60%</b>
1	Report writing	25%
2	Understanding of components	25%
3	Working in team.	10%
<b>Product related:10 Marks</b>		<b>40%</b>
1	Answers to practical related questions.	30%
5	Submission of report in time.	10%
<b>Total: 25 Marks</b>		<b>100%</b>

**List of Student Team Members**

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	



## Practical No. 16: Visit to Construction Site for Painting

### I Practical Significance

Painting and finishing of walls, wood works, grill works, is a cover or coat to protect it against termite, rusting and to make it waterproof. Wide range materials are available for these works depending upon application, material, economy and similarly the materials used for exterior works can be different from those used for interior decoration. Hence proper care and attention should be taken in the selection and application of paints in various types of building works.

### II Relevant Program Outcomes (POs) (from programme Structure)

PO 1- **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO 2- **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PO 9 - **Communication:** Communicate effectively in oral and written form.

PSO 2 – **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment.

### III Relevant Course Outcomes (from course details)

a. Select the relevant material for finishing works.

### IV Practical Outcome

Record the observation of painting in residential / public building work to prepare a report

### V Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency Implement safe building construction practices

a. Apply relevant method of painting

### VI Relevant Affective domain related

a. Follow safety practices.

b. Practice good housekeeping.

c. Demonstrate working as a leader/a team member.

### VII Minimum Theoretical Background

1. Objectives of painting

2. Characteristics of good paint

3. Surface preparation for painting

4. Types of paint

5. Method of application of paint

### VIII Experimental Set-up

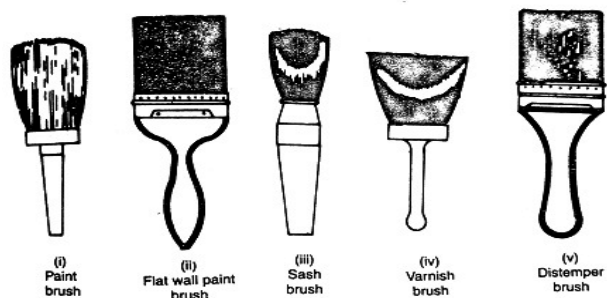


Figure 16: Painting brushes

### IX Field Visit Report

Date of Visit:	
Project: Project Name	
Site Address:	
Contractor: Contractor Name	
Architect :	
Structural Consultant -	
Project Risk Manager: Name	
Phone:	
Email:	
Reason for choosing the site –	
Date of Start of project -	
Status of Project- Completed/Ongoing,	Date of completion, if applicable -
Monitored by : Name(s) and position:	

**X Methodologies used: (You may write other than the following)**

Name of tools present on Site	The activity for which it is being used

**XI Precautions to be followed**

1. Maintain discipline during visit
2. Use safety measures on site
3. Listen and follow the instructions given by site In-charge

**XII Observations at Site: (Use blank sheet provided if space not sufficient)**

1. Type of structure  
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 .....
2. Type of paint  
 .....  
 .....
3. Procedure of painting  
 .....  
 .....  
 .....  
 .....  
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4. Attach photograph of Painting

**XIII Resources used**

Sr. No.	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
1					
2					
3					
4					

**XIV Precautions followed**

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**XVI Results**

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**XVII Interpretation of results**

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**XVIII Conclusions and Recommendations**

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**XIX Practical Related Questions**

*Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO. Write answers of minimum three questions.*

1. State the necessity of painting wall surface.
2. State different types of paints.
3. State the procedure of putty preparation for application of dry distemper.
4. State the steps in application of dry distemper.
5. State the precautions in the use of dry distemper.
6. State surface preparation for oil paint for wooden surface.
7. State the procedure of painting the external surface of wall.

[Space to Write Answers]

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**XXI Suggested Assessment Scheme**

<b>Performance Indicators</b>		<b>Weightage (%)</b>
<b>Process related:15 Marks</b>		<b>60%</b>
1	Report writing	25%
2	Understanding of components	25%
3	Working in team.	10%
<b>Product related:10 Marks</b>		<b>40%</b>
1	Answers to practical related questions.	30%
5	Submission of report in time.	10%
<b>Total: 25 Marks</b>		<b>100%</b>

***List of Student Team Members***

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

<b>Marks Obtained</b>			<b>Dated signature of Teacher</b>
<b>Process Related(15)</b>	<b>Product Related(10)</b>	<b>Total (25)</b>	

## **Practical No. 17: Market Survey for Water Proofing Materials**

### **I Practical Significance**

Waterproofing is the combination of materials used to prevent water intrusion into the structural elements of a building or its finished spaces. Its main purpose is to resist hydrostatic pressure exerted by moisture in the liquid state.

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

PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Civil engineering problems.

PO 2. **Discipline knowledge:** Apply Civil engineering knowledge to solve broad-based Civil engineering related problems.

PO 9. **Communication:** Communicate effectively in oral and written form.

PSO 2. **Construction Execution and Maintenance:** Execute civil engineering construction and maintenance using relevant materials and equipment

### **III Relevant Course Outcomes**

a. Execute safe practices in building construction activities.

### **IV Practical Outcome**

Carryout market survey for identifying various water proofing materials and prepare a report.

### **V Competency and Practical Skills**

This practical is expected to develop the following skills for the industry identified competency Implement safe building construction practices

1. Execute safe practices in building construction activities.
2. Selection of appropriate water proofing materials.

### **VI Relevant Affective domain related**

- a. Follow safety practices.
- b. Demonstrate working as a leader/a team member.

### **VII Minimum Theoretical Background**

1. Necessity of water proofing
2. Material used for water proofing
3. Methods of water proofing.

**VIII Experimental Set-up**



**Figure17: Water proofing process**

**IX Market Survey Report**

Sr. No.	Type of Material	Brand Name	Rate	Unit	Use

**X Methodologies used:**

N.A.

**XI Precautions to be followed**

1. Maintain discipline during market survey
2. Listen and follow the instructions given by supplier

**XII Observations: (Use blank sheet provided if space not sufficient)**

Information of water proofing material (Materials mention in market survey)

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**XIII Resources used**

Sr. No.	Name of Resource	Broad Specifications		Quantity	Remark
		Make	Details		
1					
2					
3					
4					

**XIV Precautions followed**

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 .....  
 .....

**XV Observations (Use blank sheet provided if space not sufficient)**

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 .....  
 .....

**XVI Results**

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 .....

**XVII Interpretation of results**

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 .....  
 .....



**XX References / Suggestions for further Reading**

<b>S. No.</b>	<b>Title of Book</b>	<b>Author</b>	<b>Publication</b>
1.	Building Construction	S. P. Arora and Bindra	Dhanpat Rai Publication, Delhi Edition 2013,ISBN: 9788189928803
2.	A to Z Building Construction	Sandip Mantri	Satya Prakashan; New Delhi (2015) ISBN-13: 978-8176849692

**XXI Suggested Assessment Scheme**

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- 2.....
- 3.....
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- 5.....

<b>Marks Obtained</b>			<b>Dated signature of Teacher</b>
<b>Process Related(15)</b>	<b>Product Related(10)</b>	<b>Total (25)</b>	





## List Of Laboratory Manuals Developed by MSBTE

### First Semester:

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

### Second Semester:

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

### Third Semester:

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

### Fourth Semester:

1	Hydraulics	22401
2	Geo Technical Engineering	22404
3	Chemical Process Instrumentation & Control	22407
4	Fluid Flow Operation	22409
5	Technology Of Organic Chemicals	22410
6	Java Programming	22412
7	GUI Application Development Using VB.net	22034
8	Microprocessor	22415
9	Database Management	22416
10	Electric Motors And Transformers	22418
11	Industrial Measurements	22420
12	Digital Electronics And Microcontroller Applications	22421
13	Linear Integrated Circuits	22423
14	Microcontroller & Applications	22426
15	Basic Power Electronics	22427

16	Digital Communication Systems	22428
17	Mechanical Engineering Measurements	22443
18	Fluid Mechanics and Machinery	22445
19	Fundamentals Of Mechatronics	22048

### Fifth Semester:

1	Design of Steel and RCC Structures	22502
2	Public Health Engineering	22504
3	Heat Transfer Operation	22510
4	Environmental Technology	22511
5	Operating Systems	22516
6	Advanced Java Programming	22517
7	Software Testing	22518
8	Control Systems and PLC's	22531
9	Embedded Systems	22532
10	Mobile and Wireless Communication	22533
11	Industrial Machines	22523
12	Switchgear and Protection	22524
13	Energy Conservation and Audit	22525
14	Power Engineering and Refrigeration	22562
15	Solid Modeling and Additive Manufacturing	22053
16	Guidelines & Assessment Manual for Micro Projects & Industrial Training	22057

### Sixth Semester:

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

### Pharmacy Lab Manual

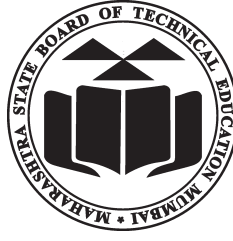
#### First Year:

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

#### Second Year:

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

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