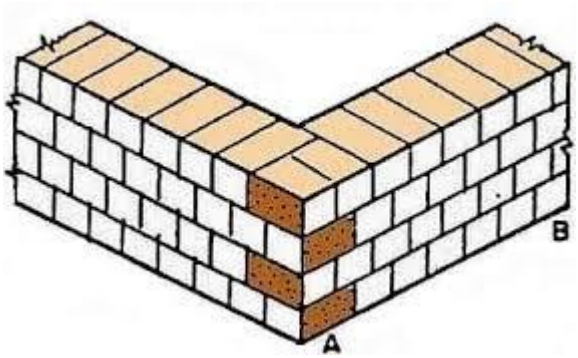
LAB MANUAL
ON
Pr 1. CONSTRUCTION WORKS PRACTICE & MS PROJECT

Diploma Civil Engineering ,6th Semester



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Pr 1. CONSTRUCTION WORKS PRACTICE & MS PROJECT

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	6th
Total Period:	75	Examination	3 hrs
Lab. periods:	5P/week	Term Work	25
Maximum marks:	50	End Semester Examination:	25

A. INTRODUCTION

Construction works involve construction, fabrication, testing and proper management. The practical course aims at exposing students at all these tasks. The course aims at imbibing the skills and attitude required at construction industries.

Microsoft Project is professional software that can help project managers. Team members will have better usability and control over hours of work. The applications help in developing plans, assigning resources to tasks, tracking budget management, workload analysis and reporting.

B. OBJECTIVES

On completion of the course students will be able to-

1. Know the construction tools and select as per requirement.
2. Construct brick walls and comprehend the challenges associated
3. Fabricate formworks and reinforcements
4. Evaluate compressive strength of concrete by conducting non-destructive tests
5. Know different plumbing tools and fixtures
6. Use MS Project to plan, schedule and report a project

C. List of Experiment

Chapter	Name of topics	Hours
PART I: Construction work Practices		
1	Tools for construction of masonry	06
2	Construction of brick walls	06
3	Formwork fabrication	08
4	Fabrication of reinforcements	10
5	Non-destructive tests for concrete	05
6	Pipe joints and Plumbing fixtures	05
	PART II: MS Project	
1	Introduction to Microsoft Project	04
2	Creating a project plan	05

3	Basics of Microsoft Project	06
4	Tracking the project progress	06
5	Project Reporting	07
6	Custom views and field	07

A. COURSE CONTENTS

PART I: Construction work Practices

1 Study of tools required for construction of masonry.

2 Lay out Plan of a building.

3 Construction of 1 &1 ½ Brick thick walls in English Bond in Mud mortar including a corner.

4 Construction of 1 &1 ½ Brick thick Pillar in Mud mortar.

5 Bar bending and fabrication of reinforcements for a beam.

6 Bar bending and fabrication of reinforcements for a slab.

7 Bar bending and fabrication of reinforcements for a lintel with chajja.

8 Bar bending and fabrication of reinforcements for a column.

9 Conducting a Non destructive compressive strength test on concrete beam using rebound Hammer as per I.S:1311(Part-2)-1992.

10 Study of pipe joints and plumbing fixtures.

11 **Field visits:**

Visit to a construction site of a building where the following works are in progress.

Excavation of foundation, b) Masonry works, c) Plumbing works d) Painting (interior/ exterior), e) Wood works, f) Fabrication & concreting works, g)Flooring

PART II: MS Project

1 **Introduction to Microsoft Project**

1.3 Project Management-Definition & concept

2.3 Features of Microsoft project

3.3 MS project scheduling for engineering

2 **Creating a project plan**

1.3 Basic information for a new project

2.3 Creating project from a blank

3.3 Creating project from existing

3 **Basics of Microsoft Project**

1.3 Estimating a project

2.3 Project Task

3.3 Project Resources

4 **Tracking the project progress**

5 **Project Reporting**

6 **Custom views and field**

PART I: Construction work Practices

Experiment No: 01

Title: Study of Tools Required for Construction of Masonry

Objective:

To study and understand the various tools used in masonry construction, their functions, and their applications in building work.

Apparatus Required:

1. Trowels (Bricklayer's trowel, Pointing trowel)
2. Mason's Hammer
3. Plumb Bob
4. Spirit Level
5. Mason's Square
6. Line and Pins
7. Float (Wooden/Steel)
8. Measuring Tape
9. Bolster Chisel
10. Mortar Pan

Theory:

Masonry construction involves laying bricks, stones, or concrete blocks with mortar to form walls, columns, and other structures. Various tools are required to perform these tasks efficiently and ensure structural accuracy. Understanding these tools helps in proper execution and quality control in masonry work.

Common Masonry Tools and Their Functions:

1. **Trowels** – Used for spreading and leveling mortar.

2. **Mason's Hammer** – Used for cutting and shaping bricks.
3. **Plumb Bob** – Ensures vertical alignment of masonry work.
4. **Spirit Level** – Checks horizontal and vertical accuracy.
5. **Mason's Square** – Helps in maintaining right angles.
6. **Line and Pins** – Used for guiding brick courses.
7. **Float** – Used for finishing and smoothing mortar surfaces.
8. **Measuring Tape** – Measures dimensions accurately.
9. **Bolster Chisel** – Used for cutting bricks and stones.
10. **Mortar Pan** – Holds and carries mortar for bricklaying.

Procedure:

1. Identification of Masonry Tools:

- Collect different masonry tools.
- Observe their design, size, and material.
- Record their specific functions in masonry work.

2. Demonstration of Tool Usage:

- Demonstrate how to apply and spread mortar using a trowel.
- Show the cutting of bricks using a mason's hammer and bolster chisel.
- Check the vertical alignment of a wall using a plumb bob.
- Use a spirit level to check horizontal leveling.
- Demonstrate the use of line and pins for guiding brick layers.

3. Observation and Analysis:

- Note how each tool contributes to masonry work.
- Compare different tools based on efficiency and ease of use.
- Identify the importance of each tool in ensuring quality construction.

Precautions:

- Handle sharp tools like chisels and hammers carefully.
- Use proper techniques to avoid injuries.
- Wear safety gloves and goggles while cutting bricks.
- Ensure tools are clean and in good condition before use.

Observations and Calculations:

- List and describe different masonry tools with their applications.
- Measure and compare the accuracy of tools like the plumb bob and spirit level.
- Record any challenges faced in handling specific tools.

Result:

The study and demonstration of masonry tools were successfully carried out, and their functions, applications, and handling techniques were understood.

Conclusion:

This experiment provided practical knowledge of various masonry tools used in construction. Understanding their proper usage helps in improving efficiency, accuracy, and the quality of masonry work.

Viva Questions:

1. What are the different types of trowels used in masonry?
2. How does a plumb bob help in masonry work?
3. What is the function of line and pins in bricklaying?
4. Why is a spirit level important in construction?
5. How can a mason's hammer be used effectively?

What Are Construction Tools?

Tools and instruments that are used in construction work known as construction tools. The study of tools required for the construction of masonry in civil engineering is essential to understanding how buildings and structures are built using stone, brick, concrete blocks, and other materials. Masonry is one of the oldest construction techniques and is widely used due to its durability, strength, and aesthetic appeal. Here is an overview of the tools required for masonry construction.

1. Tape

It consists of a flexible ribbon of plastic, fiber glass, or metal strip with linear-measurement markings. This is used to measure length, size, or distance.

2. Masonry Trowel

It is a hand tool used in brickwork, stonework, or plastering for placing, leveling, shaping, and smoothing mortar or concrete. They are available in various shapes and sizes depending upon the work.

3. Head Pan

It is a round container, like a bowl used to transport construction materials.

4. Plumb Bob

Plumb bob is a small weight with a pointed tip, hangs from a string. This is one of the most important construction tools used to check vertical alignment for civil works.

5. Hoe

It is a long-handled tool with a sharp metal blade used for digging, mixing concrete ingredients, placing mortar/concrete in head pan etc.

6. Wooden Float

This tool has a plane surface used to make concrete surface smooth during plastering and finishing.

7. Spade

A long-handled tool consisting of a blade, stunted and less curved than that of a shovel mainly used for digging purposes.

8. Digging Bar

This is used for digging and loosing the soil.

9. Crow Bar

A crowbar is a metal tool used mainly for removing the nails from shuttering boards.

10. Wheel Barrow

Wheel barrow is a construction tool having one wheel and two handles that is used to transport concrete, soil or any other material from one place to another place.

11. Hammer

A hammer is a tool consisting of a weighted head fixed to a long handle that is used to drive nails into shuttering boards, walls, etc.

12. Chisel

This tool is used to remove excess concrete from hardened surface.

13. Bump Cutter/Screed

This tool is made of wood, mainly used to level fresh concrete and provide a smooth surface especially in the concrete slab.

14. Vacuum Blower

It is used to clean dust from floor or concrete slab.

15. Needle Vibrator

This construction tool is very essential during pouring of concrete into reinforcement. It is used for compaction of the concrete perfectly.

15. Earth Rammer

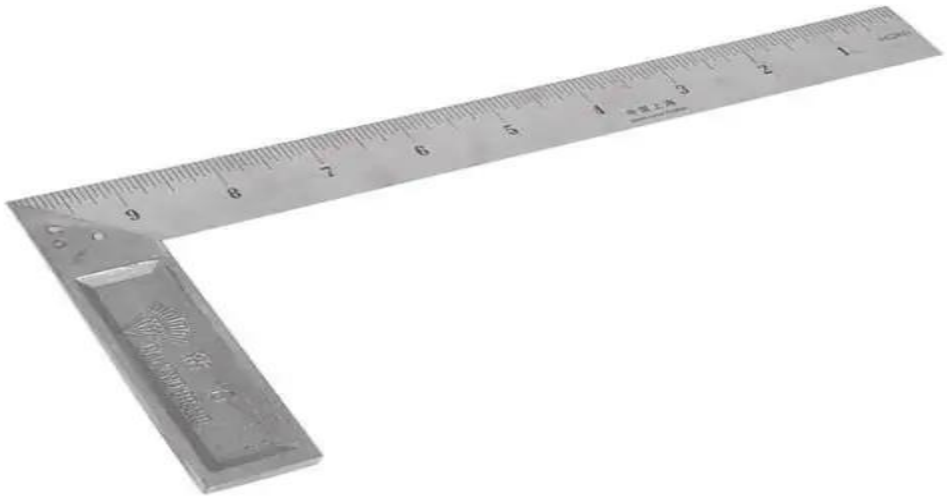
This tool is used to level the ground soil.

16. Tamper

A tamper is a hand tool used to compress or compact earth or soil. Compacting the earth makes it hard and level, a suitable groundwork for projects that need a hard, flat surface.

17. Right Angle Frame

It is used to check the right angle of masonry or plastering work.



18. Polisher

It is an electrically driven polishing machine used to polish granite/marbles. This helps to provide a very smooth surface of marbles.

19. Concrete Mixer

This is a construction tool used to mix cement, sand, aggregates and water manually and produce concrete.

20. Sand Screening Machine

It is used to sieve sand for use in construction work. Sand is poured on the sieve or mesh which vibrates and separate fine grain sand easily.

21. Drill

Drill machine is used to make a hole of circular cross-section in solid materials like wood, steel, concrete, etc.

22. Hand Saw

It is a hand tool used to cut wood for shuttering and other works.

23. Circular Saw

It is an electrically driven machine consisting of a circular blade used to cut wood, steel rods, etc. The use of hand saw is now replaced by this tool.

24. Block Plane / Jack Plane

This tool is used to make wood surface smooth and plane for doors and windows.

25. Jack Hammer

These construction tools are used to demolish old concrete, break stones, remove pavement, and demolish many other surfaces in construction projects.

26. Tile Cutter

It is used in tiling or marble work. By this tool tiles or marbles are cut to the required size and shape.

27. Line Level

It is a small tool that is used to check the horizontal surface level in brickwork, plastering, flooring, plumbing, electric, and tile works.

28. Torpedo Level

This tool is a combination of line level and framing square.

29. Water Level

An U-shaped tube is used to check the level by means of the surface of water.

30. Brick Bolster

It is like a chisel used to cut bricks. Its cutting edge enables for accurate cutting of bricks.

31. Binding Hook

It is one of the useful construction tools to tie binding wires in reinforcement.

32. Ladder

Ladder is used to climb up or climb down.

33. Measuring Box

It is used to measure the quantity of cement, sand, or aggregates for concrete.

34. Putty Knife

A putty knife is a hand tool used in putty finishing to limit the thickness of the putty.

35. Welding Machine

This machine is used for welding purposes to joint different pieces of steel or rods.

36. De-Watering Pump

Dewatering pumps are used to remove water from a construction site, building site, pond, and other areas.

37. Measuring Wheel

This construction tool is used to measure lengths.

38. Rebound Hammer

It is used to check the compressive strength of concrete.

39. Scoop

It is used in quality control department for material.

40. Line and Pins

This consists of a thread whose ends are connected with two solid metal rods with pointed tips. It is used to level the alignment of the brick course during brick laying.

41. Straight Edge Brush

It is used to provide good finishing to the plastered surface especially at the corners and edges of walls.

42. Wire Brush

It is used to clean concrete surface and other materials.

43. Scratcher

It is used to scratch first layer of plastering.

Safety Tools:

Here I am including safety tools in the construction tools list because safety should be first priority in any construction work.

44. Helmet

Safety helmet is must in construction works. Safety helmets will protect the user's head against impact from objects falling from height, or any fatal accident.

45. Hand Gloves

These are used to avoid direct contact with harmful chemicals, dangerous tools, or machines.

46. Safety Glass

This is used to save our eyes while drilling, hacking/roughening, grinding.

47. Safety Belt

Safety belt is must to work on heights.

48. Rubber Boots

These are to prevent skin from direct chemical contact, dangerous machines and tools.

Experiment No: 2

Title: Layout Plan of a Building on Site

Objective: To understand and execute the process of marking the layout of a building on-site based on given drawings and specifications.

Apparatus Required:

1. Measuring Tape
2. Pegs and Nails
3. Lime Powder/Chalk
4. Wooden Hammer
5. Plumb Bob
6. Spirit Level
7. Theodolite/Total Station (if available)
8. Strings or Nylon Threads

9. Drawing Sheets with Plan Details

Theory: The layout of a building is the process of transferring the plan from paper to the ground. It ensures the correct positioning, dimensions, and orientation of the structure as per the design specifications. Proper layout marking is essential to avoid construction errors and ensure the structural stability of the building.

Procedure:

1. **Site Preparation:** Clear the site of debris and vegetation to provide a clean working surface.
2. **Referencing and Benchmarking:** Establish a reference point (benchmark) based on site conditions and survey details.
3. **Marking the Baseline:**
    a. Identify and mark the main reference line (baseline) using pegs and a measuring tape.
    b. Ensure it aligns with the site and follows the site plan's orientation.
4. **Marking the Corners:**
    a. Use right-angle techniques (3-4-5 method) or theodolite to mark exact corners.
    b. Fix pegs at the corners and connect them using strings.
5. **Fixing the Grid Lines:**
    a. Extend grid lines using chalk powder or string to ensure precise measurements.
6. **Verifying the Layout:**
    a. Use a plumb bob, theodolite, and measuring tape to check alignments.
    b. Cross-check distances and angles to ensure accuracy.
7. **Final Approval:**
    a. Once confirmed, approve the layout for further excavation and foundation work.

Precautions:

- Ensure all measurements are accurate and verified.
- Use proper tools for marking to avoid errors.
- Maintain correct orientation as per the plan.
- Double-check all corner angles and distances before proceeding with excavation.

Observations and Calculations:

- Record all measurements taken during the layout process.
- Verify distances between different points and compare them with the site plan.
- Ensure perpendicular alignments using the 3-4-5 method.

Result: The layout of the building was successfully marked on-site as per the given specifications.

Conclusion: The experiment provided practical knowledge of site layout planning, enabling accurate transfer of architectural drawings to the ground. This step is crucial for ensuring proper construction alignment and structural stability.

Viva Questions:

1. Why is a layout plan necessary before construction?
2. What is the significance of a benchmark in layout marking?
3. Explain the 3-4-5 method used in layout marking.
4. How can errors in layout marking be minimized?
5. What instruments are used for ensuring accurate layout measurements?

Experiment No: 3

Title: Construction of 1 and 1 1/2 Brick Thick Walls using English Bond with Mud Mortar

Objective: To understand and execute the process of constructing 1 and 1 1/2 brick thick walls using the English bond with mud mortar.

Apparatus Required:

1. Bricks
2. Mud Mortar
3. Measuring Tape
4. Trowel
5. Plumb Bob
6. Spirit Level
7. String Line
8. Wooden Hammer
9. Water Container

Theory: Brick masonry is a method of constructing walls using bricks bonded together with mortar. The English bond is one of the strongest and most commonly used bonds, alternating headers and stretchers in each course. Using mud mortar, an eco-friendly and cost-effective binding material, provides a traditional approach to construction.

Procedure:

1. **Site Preparation:**
    a. Level the ground where the wall is to be constructed.
    b. Soak bricks in water for at least one hour before use.
2. **Marking the Layout:**
    a. Mark the wall's alignment on the ground using string lines.
    b. Ensure right angles using the 3-4-5 method.
3. **Laying the First Course:**
    a. Spread a uniform layer of mud mortar along the marked alignment.
    b. Lay the first course of bricks, ensuring proper alignment and leveling.
4. **Building the Wall:**
    a. Alternate between stretcher and header courses as per the English bond pattern.
    b. Check verticality using a plumb bob and horizontal level using a spirit level.
    c. Maintain uniform mortar thickness and remove excess mortar.
5. **Constructing 1 1/2 Brick Thick Wall:**
    a. Follow the same method as a 1-brick wall but include an additional header course for added thickness.
6. **Curing:**

a. Sprinkle water over the masonry periodically to allow proper curing.
b. Let the wall set for at least 24 hours before applying load.

Precautions:

- Ensure uniform mortar thickness for strong bonding.
- Regularly check verticality and alignment to avoid deviations.
- Soak bricks in water before use to prevent excessive absorption of water from the mortar.
- Avoid using cracked or broken bricks.

Observations and Calculations:

- Measure the height and thickness of the constructed wall.
- Verify the correctness of the English bond pattern.
- Check the level and verticality using a spirit level and plumb bob.

Result: The 1 and 1 1/2 brick thick walls were successfully constructed using the English bond with mud mortar.

Conclusion: This experiment provided hands-on experience in constructing brick masonry using the English bond. It highlighted the importance of proper bonding, alignment, and curing in achieving a strong and durable wall.

Viva Questions:

1. What is the English bond in brick masonry?
2. Why is it necessary to soak bricks before use?
3. What are the advantages of using mud mortar?
4. How is the verticality of a wall checked during construction?
5. What is the difference between a 1-brick and a 1 1/2-brick thick wall?

Experiment No:04

Title: Construction of 1 and 1 1/2 Brick Thick Walls using Flemish Bond with Mud Mortar

Objective: To understand and execute the process of constructing 1 and 1 1/2 brick thick walls using the Flemish bond with mud mortar.

Apparatus Required:

1. Bricks
2. Mud Mortar
3. Measuring Tape
4. Trowel
5. Plumb Bob
6. Spirit Level
7. String Line
8. Wooden Hammer
9. Water Container

Theory: Brick masonry is a method of constructing walls using bricks bonded together with mortar. The Flemish bond is a strong and aesthetically pleasing bond where headers and stretchers are placed alternately in each course. Using mud mortar, an eco-friendly and cost-effective binding material, provides a traditional approach to construction.

Procedure:

1. **Site Preparation:**
    a. Level the ground where the wall is to be constructed.
    b. Soak bricks in water for at least one hour before use.
2. **Marking the Layout:**
    a. Mark the wall's alignment on the ground using string lines.
    b. Ensure right angles using the 3-4-5 method.
3. **Laying the First Course:**
    a. Spread a uniform layer of mud mortar along the marked alignment.
    b. Lay the first course of bricks, ensuring proper alignment and leveling.
4. **Building the Wall:**
    a. Alternate between headers and stretchers within each course as per the Flemish bond pattern.
    b. Check verticality using a plumb bob and horizontal level using a spirit level.
    c. Maintain uniform mortar thickness and remove excess mortar.
5. **Constructing 1 1/2 Brick Thick Wall:**
    a. Follow the same method as a 1-brick wall but include an additional header course for added thickness.
6. **Curing:**
    a. Sprinkle water over the masonry periodically to allow proper curing.
    b. Let the wall set for at least 24 hours before applying load.

Precautions:

- Ensure uniform mortar thickness for strong bonding.
- Regularly check verticality and alignment to avoid deviations.
- Soak bricks in water before use to prevent excessive absorption of water from the mortar.
- Avoid using cracked or broken bricks.

Observations and Calculations:

- Measure the height and thickness of the constructed wall.
- Verify the correctness of the Flemish bond pattern.
- Check the level and verticality using a spirit level and plumb bob.

Result: The 1 and 1 1/2 brick thick walls were successfully constructed using the Flemish bond with mud mortar.

Conclusion: This experiment provided hands-on experience in constructing brick masonry using the Flemish bond. It highlighted the importance of proper bonding, alignment, and curing in achieving a strong and durable wall.

Viva Questions:

1. What is the Flemish bond in brick masonry?
2. Why is it necessary to soak bricks before use?
3. What are the advantages of using mud mortar?
4. How is the verticality of a wall checked during construction?
5. What is the difference between a 1-brick and a 1 1/2-brick thick wall?

Experiment No: 05

Title: Construction of 1 and 1 1/2 Brick Thick Pillars using Pillar Bond with Mud Mortar

Objective:

To understand and execute the process of constructing 1 and 1 1/2 brick thick pillars using the pillar bond with mud mortar.

Apparatus Required:

1. Bricks
2. Mud Mortar
3. Measuring Tape
4. Trowel
5. Plumb Bob
6. Spirit Level
7. String Line
8. Wooden Hammer
9. Water Container

Theory:

Brick masonry is a method of constructing vertical structures using bricks bonded together with mortar. The **pillar bond** is designed for constructing isolated brick columns or piers, ensuring strength and stability. A 1-brick thick pillar consists of bricks arranged in a square or rectangular pattern, whereas a 1 1/2-brick thick pillar incorporates additional headers for extra strength. Using **mud mortar**, an eco-friendly and cost-effective binding material, provides a traditional and sustainable construction approach.

Procedure:

1. Site Preparation:

- Level the ground where the pillar is to be constructed.
- Soak bricks in water for at least one hour before use.

2. Marking the Layout:

- Mark the position of the pillar on the ground using string lines and chalk.
- Ensure proper alignment and right angles for stability.

3. Laying the First Course:

- Spread a uniform layer of mud mortar at the marked location.
- Lay the first course of bricks in a square or rectangular pattern, ensuring proper alignment and leveling.

4. Building the Pillar:

- Arrange bricks in a pillar bond pattern to maintain structural integrity.
- Use headers and stretchers as required for 1 and 1 1/2 brick thick pillars.
- Check verticality using a plumb bob and horizontal level using a spirit level.
- Maintain uniform mortar thickness and remove excess mortar.

5. Constructing 1 1/2 Brick Thick Pillar:

- Follow the same method as a 1-brick pillar but include an additional layer of headers for added thickness.

6. Curing:

- Sprinkle water over the masonry periodically to allow proper curing.
- Let the pillar set for at least 24 hours before applying any load.

Precautions:

- Ensure uniform mortar thickness for strong bonding.
- Regularly check verticality and alignment to avoid deviations.
- Soak bricks in water before use to prevent excessive absorption of water from the mortar.
- Avoid using cracked or broken bricks.

Observations and Calculations:

- Measure the height and thickness of the constructed pillar.
- Verify the correctness of the pillar bond pattern.
- Check the level and verticality using a spirit level and plumb bob.

Result:

The **1 and 1 1/2 brick thick pillars** were successfully constructed using the **pillar bond with mud mortar**.

Conclusion:

This experiment provided **hands-on experience** in constructing **brick pillars** using the **pillar bond**. It highlighted the importance of **proper bonding, alignment, and curing** in achieving a **strong and stable structure**.

Viva Questions:

1. What is the pillar bond in brick masonry?
2. Why is it necessary to soak bricks before use?
3. What are the advantages of using mud mortar?
4. How is the verticality of a pillar checked during construction?
5. What is the difference between a 1-brick and a 1 1/2-brick thick pillar?

Experiment No: 06

Title: Bar Bending and Fabrication of Reinforcement for a Beam

Objective:

To understand and execute the process of bar bending and fabrication of reinforcement for a beam as per standard construction practices.

Apparatus Required:

1. Mild Steel (MS) or High Yield Strength Deformed (HYSD) bars
2. Measuring Tape
3. Bar Bending Schedule (BBS)
4. Bar Bending Machine/Hand Tools (Hacksaw, Pliers, Chisels, Hammers)
5. Binding Wire
6. Steel Cutter
7. Bench Vice
8. Welding Equipment (if required)
9. Safety Gloves and Goggles

Theory:

Reinforcement bars (rebars) provide tensile strength to concrete structures. Proper bar bending and fabrication ensure that the beam withstands loads efficiently. The bending and placement of bars must follow the **Bar Bending Schedule (BBS)**, which provides details like bar length, diameter, bend angles, and cutting dimensions. Proper tying and spacing of bars are crucial for structural stability.

Procedure:

1. Interpretation of Bar Bending Schedule (BBS):

- Understand the reinforcement details for the beam as per structural drawings.
- Identify different types of bars such as main bars, stirrups, and distribution bars.

2. Cutting and Bending of Bars:

- Measure and cut the reinforcement bars to the required lengths using a steel cutter.
- Bend the bars according to the BBS using a bar bending machine or manually using a vice and hammer.
- Ensure accurate bending angles as per the drawing specifications.

3. Fabrication of Reinforcement Cage:

- Position the **main reinforcement bars** as per the beam design.
- Place stirrups at specified intervals and tie them securely with binding wire.
- Ensure proper spacing between bars using spacers or cover blocks.
- Check alignment and rigidity of the reinforcement cage.

4. Final Inspection:

- Verify dimensions and positioning of bars against the drawings.
- Ensure proper overlap and anchorage where necessary.
- Check for any loose ties and secure them properly.

Precautions:

- Follow safety guidelines while handling cutting and bending tools.
- Maintain accurate bending angles as per the structural design.
- Ensure proper lapping and anchorage of bars.

- Avoid excessive bending and rebending to prevent material weakening.
- Use appropriate cover blocks to maintain concrete cover.

Observations and Calculations:

- Measure the cut lengths of the reinforcement bars.
- Verify the spacing of stirrups and placement of bars.
- Check the reinforcement cage dimensions before concreting.

Result:

The reinforcement for the beam was successfully fabricated as per the given specifications and structural requirements.

Conclusion:

This experiment provided hands-on experience in bar bending and fabrication of reinforcement for a beam. It highlighted the importance of **accurate cutting, bending, spacing, and tying** in ensuring structural integrity.

Viva Questions:

1. What is a Bar Bending Schedule (BBS)?
2. Why is reinforcement required in a concrete beam?
3. What are the different types of bars used in a beam?
4. What is the purpose of stirrups in beam reinforcement?
5. How do you ensure proper anchorage of reinforcement bars?

Experiment No: 07

Title: Bar Bending and Fabrication of Reinforcement for a Slab

Objective:

To understand and execute the process of bar bending and fabrication of reinforcement for a slab as per standard construction practices.

Apparatus Required:

1. Mild Steel (MS) or High Yield Strength Deformed (HYSD) bars
2. Measuring Tape
3. Bar Bending Schedule (BBS)
4. Bar Bending Machine/Hand Tools (Hacksaw, Pliers, Chisels, Hammers)
5. Binding Wire
6. Steel Cutter
7. Bench Vice
8. Welding Equipment (if required)
9. Safety Gloves and Goggles

Theory:

Reinforcement bars (rebars) provide tensile strength to concrete structures. Proper bar bending and fabrication ensure that the slab withstands loads efficiently. The bending and placement of bars must follow the **Bar Bending Schedule (BBS)**, which provides details like bar length, diameter, bend angles, and cutting dimensions. Proper tying and spacing of bars are crucial for structural stability.

Procedure:

1. Preparation and Planning:

- Study the structural drawings and bar bending schedule (BBS) to understand reinforcement details.
- Mark the slab area and identify positions for main and distribution bars.

2. Cutting and Bending of Bars:

- Measure and cut the reinforcement bars to the required lengths using a steel cutter.
- Use a bar bending machine or manual tools to bend the bars according to the specified angles in the BBS.
- Ensure proper bending of crank bars where required to maintain the structural integrity of the slab.

3. Placement of Reinforcement Bars:

- Position the **main reinforcement bars** (bottom layer) according to the drawing.
- Place distribution bars perpendicular to the main bars, maintaining proper spacing.
- Secure the bars at intersections using binding wire to ensure stability.

- Insert crank bars at specified locations to enhance load distribution.
- Ensure sufficient concrete cover by placing cover blocks beneath the reinforcement.

4. Checking and Adjustments:

- Verify the alignment and spacing of bars using a measuring tape.
- Ensure that the bars are properly tied and do not shift during concreting.
- Check for overlaps and anchorage length as per the design specifications.

5. Final Inspection:

- Cross-check reinforcement details against the structural drawing.
- Inspect the binding and rigidity of the reinforcement mesh.
- Ensure that cover blocks are placed correctly to maintain adequate concrete cover.
- Make necessary corrections before proceeding with concreting.

Precautions:

- Follow safety guidelines while handling cutting and bending tools.
- Maintain accurate bending angles as per the structural design.
- Ensure proper lapping and anchorage of bars.
- Avoid excessive bending and rebending to prevent material weakening.
- Use appropriate cover blocks to maintain concrete cover.

Observations and Calculations:

- Measure the cut lengths of the reinforcement bars.
- Verify the spacing of distribution bars and placement of main bars.
- Check the reinforcement mesh dimensions before concreting.

Result:

The reinforcement for the slab was successfully fabricated as per the given specifications and structural requirements.

Conclusion:

This experiment provided hands-on experience in bar bending and fabrication of reinforcement for a slab. It highlighted the importance of **accurate cutting, bending, spacing, and tying** in ensuring structural integrity.

Viva Questions:

1. What is a Bar Bending Schedule (BBS)?
2. Why is reinforcement required in a concrete slab?
3. What are the different types of bars used in a slab?
4. What is the purpose of crank bars in slab reinforcement?
5. How do you ensure proper anchorage of reinforcement bars?

Experiment No: 08

Title: Bar Bending and Fabrication of Reinforcement for a Lintel with Chajja

Objective:

To understand and execute the process of bar bending and fabrication of reinforcement for a lintel with chajja as per standard construction practices.

Apparatus Required:

1. Mild Steel (MS) or High Yield Strength Deformed (HYSD) bars
2. Measuring Tape

3. Bar Bending Schedule (BBS)
4. Bar Bending Machine/Hand Tools (Hacksaw, Pliers, Chisels, Hammers)
5. Binding Wire
6. Steel Cutter
7. Bench Vice
8. Welding Equipment (if required)
9. Safety Gloves and Goggles

Theory:

A lintel is a horizontal structural element placed over openings like doors and windows to support the load from the structure above. A chajja (sunshade) is an extended slab projection that protects windows and doors from direct sunlight and rain. Reinforcement in lintels and chajjas helps resist bending and shear forces, improving structural stability. The reinforcement design follows the **Bar Bending Schedule (BBS)**, which provides details like bar length, diameter, bend angles, and spacing.

Procedure:

1. Preparation and Planning:

- Study the structural drawings and Bar Bending Schedule (BBS) to understand reinforcement details for the lintel and chajja.
- Mark the positions of main reinforcement, distribution bars, and extra reinforcement required for the chajja extension.

2. Cutting and Bending of Bars:

- Measure and cut the reinforcement bars to the required lengths using a steel cutter.
- Use a bar bending machine or manual tools to bend the bars as per the BBS.
- Ensure proper bending angles, hooks, and cranks to maintain the structural integrity of the lintel and chajja.

3. Placement of Reinforcement Bars:

- Position the **main reinforcement bars** in the lintel according to the drawing.
- Place stirrups (links) at regular intervals to hold the main bars in position and provide shear resistance.
- Extend the reinforcement bars to form the chajja, ensuring proper anchorage.
- Tie the bars at intersections using binding wire to secure them in place.
- Use cover blocks to maintain appropriate concrete cover.

4. Checking and Adjustments:

- Verify the alignment and spacing of bars using a measuring tape.
- Ensure that the bars are properly tied and do not shift during concreting.
- Check for proper overlap and anchorage of bars as per design requirements.

5. Final Inspection:

- Cross-check reinforcement details against the structural drawing.
- Inspect the binding and rigidity of the reinforcement framework.
- Ensure that cover blocks are placed correctly to maintain adequate concrete cover.
- Make necessary corrections before proceeding with concreting.

Precautions:

- Follow safety guidelines while handling cutting and bending tools.
- Maintain accurate bending angles as per the structural design.
- Ensure proper lapping and anchorage of bars.
- Avoid excessive bending and rebending to prevent material weakening.
- Use appropriate cover blocks to maintain concrete cover.

Observations and Calculations:

- Measure the cut lengths of the reinforcement bars.
- Verify the spacing of stirrups and placement of main bars.
- Check the reinforcement framework dimensions before concreting.

Result:

The reinforcement for the lintel with chajja was successfully fabricated as per the given specifications and structural requirements.

Conclusion:

This experiment provided hands-on experience in bar bending and fabrication of reinforcement for a lintel with chajja. It highlighted the importance of **accurate cutting, bending, spacing, and tying** in ensuring structural integrity.

Viva Questions:

1. What is the function of a lintel in a building structure?

2. Why is reinforcement required in a lintel with a chajja?
3. What are the different types of bars used in a lintel reinforcement?
4. What is the purpose of stirrups in lintel reinforcement?
5. How do you ensure proper anchorage of reinforcement bars in a lintel with a chajja?

Experiment No: 09

Title: Bar Bending and Fabrication of Reinforcement for a Column

Objective:

To understand and execute the process of bar bending and fabrication of reinforcement for a column as per standard construction practices.

Apparatus Required:

1. Mild Steel (MS) or High Yield Strength Deformed (HYSD) bars
2. Measuring Tape
3. Bar Bending Schedule (BBS)
4. Bar Bending Machine/Hand Tools (Hacksaw, Pliers, Chisels, Hammers)
5. Binding Wire

6. Steel Cutter
7. Bench Vice
8. Welding Equipment (if required)
9. Safety Gloves and Goggles

Theory:

A column is a vertical structural member designed to transfer loads from slabs, beams, and roofs to the foundation. Reinforcement bars in a column provide tensile strength and resist buckling under axial loads. The reinforcement consists of **longitudinal bars (main bars)** and **lateral ties (stirrups)** to hold the main bars in position and provide stability. The reinforcement design follows the **Bar Bending Schedule (BBS)**, which provides details like bar length, diameter, spacing, and bend angles.

Procedure:

1. Preparation and Planning:

- Study the structural drawings and Bar Bending Schedule (BBS) to understand reinforcement details for the column.
- Identify the number of longitudinal bars and stirrups required.

2. Cutting and Bending of Bars:

- Measure and cut the main reinforcement bars to the required lengths using a steel cutter.
- Use a bar bending machine or manual tools to bend the stirrups as per the BBS.
- Ensure proper bending angles and hooks in the stirrups for adequate load distribution.

3. Placement of Reinforcement Bars:

- Position the **longitudinal reinforcement bars** as per the drawing.
- Place and tie the stirrups at specified intervals using binding wire to hold the main bars in position.
- Ensure proper spacing between the bars using spacers.
- Use cover blocks to maintain the required concrete cover.

4. Checking and Adjustments:

- Verify the alignment and spacing of bars using a measuring tape.
- Ensure that all reinforcement bars are securely tied and do not shift during concreting.
- Check for adequate lap length and anchorage of bars as per design specifications.

5. Final Inspection:

- Cross-check reinforcement details against the structural drawing.
- Inspect the binding and rigidity of the reinforcement cage.
- Ensure that cover blocks are placed correctly to maintain adequate concrete cover.
- Make necessary corrections before proceeding with concreting.

Precautions:

- Follow safety guidelines while handling cutting and bending tools.
- Maintain accurate bending angles as per the structural design.
- Ensure proper lapping and anchorage of bars.
- Avoid excessive bending and rebending to prevent material weakening.
- Use appropriate cover blocks to maintain concrete cover.

Observations and Calculations:

- Measure the cut lengths of the reinforcement bars.
- Verify the spacing of stirrups and placement of main bars.
- Check the reinforcement framework dimensions before concreting.

Result:

The reinforcement for the column was successfully fabricated as per the given specifications and structural requirements.

Conclusion:

This experiment provided hands-on experience in bar bending and fabrication of reinforcement for a column. It highlighted the importance of **accurate cutting, bending, spacing, and tying** in ensuring structural integrity.

Viva Questions:

1. What is the function of reinforcement in a column?
2. Why are stirrups used in column reinforcement?
3. What is the significance of lap length in column reinforcement?
4. What is the minimum cover required for column reinforcement?

5. How do you ensure proper alignment of reinforcement bars in a column?

Experiment No:10

Title: Conducting a Non-Destructive Compressive Strength Test on Concrete Beam Using Rebound Hammer Test as per IS: 1311 (Part-2)-1992

Objective:

To determine the compressive strength of a concrete beam using the rebound hammer test, following the guidelines of IS: 1311 (Part-2)-1992.

Apparatus Required:

1. Schmidt Rebound Hammer
2. Measuring Tape
3. Concrete Beam Sample
4. Smoothening Tool (for surface preparation)
5. Calibration Chart (as per IS Code)
6. Safety Gloves and Goggles

Theory:

The **rebound hammer test** is a non-destructive testing (NDT) method used to estimate the **compressive strength** of concrete. The rebound hammer measures the surface hardness of concrete by impacting it with a spring-loaded mass and recording the rebound value. Higher rebound values generally indicate higher compressive strength.

The test follows the IS: 1311 (Part-2)-1992 guidelines and is widely used for quality control and in-situ strength estimation of concrete structures.

Procedure:

1. Preparation and Selection of Testing Points:

- Identify at least **six test points** on the concrete beam, ensuring they are free from cracks, rough patches, or coatings.
- Clean and smoothen the surface using a grinding stone if necessary.

2. Calibration of Rebound Hammer:

- Check the **calibration of the rebound hammer** using a standard test anvil before conducting the test.
- Ensure the hammer is functioning correctly as per IS standards.

3. Conducting the Test:

- Hold the rebound hammer **perpendicular** to the test surface.
- Press the hammer against the beam until the hammer plunger impacts the concrete surface.
- Record the **rebound number** displayed on the scale.
- Repeat the test **at least six times** at different locations and note down the values.

4. Interpretation of Results:

- Compute the **average rebound number** from the readings.
- Refer to the **calibration chart** provided in IS: 1311 (Part-2)-1992 to estimate the **compressive strength** of the concrete based on the rebound values.
- Compare the results with the required design strength of the concrete beam.

Precautions:

- Ensure the test surface is **clean and dry** for accurate readings.
- Hold the rebound hammer **firmly and perpendicular** to avoid measurement errors.
- Do not test over reinforcement bars as they may give false readings.
- Discard extreme values that deviate significantly from the average reading.
- Calibrate the hammer regularly as per IS code requirements.

Observations and Calculations:

- Record the individual **rebound numbers** at different test points.
- Calculate the **average rebound number**.
- Determine the **compressive strength** using the IS code calibration chart.

Result:

The estimated **compressive strength** of the concrete beam was determined successfully using the rebound hammer test, as per IS: 1311 (Part-2)-1992.

Conclusion:

This experiment provided hands-on experience in conducting a **non-destructive test** to estimate the **compressive strength** of concrete. The **rebound hammer test** is an effective method for in-situ strength evaluation and quality control of concrete structures.

Viva Questions:

1. What is the purpose of the rebound hammer test?
2. How does the rebound number correlate with concrete strength?
3. What precautions should be taken while conducting this test?
4. What factors can affect the accuracy of the rebound hammer test?
5. How is the rebound hammer calibrated?

Experiment No: 11

Title: Study of Pipe Joints and Plumbing Fixtures

Objective:

To study different types of pipe joints and plumbing fixtures used in water supply and drainage systems.

Apparatus Required:

1. Various types of pipes (PVC, GI, CPVC, PPR, Copper, etc.)
2. Pipe fittings (Elbows, Tees, Couplings, Reducers, Unions, etc.)
3. Pipe jointing materials (Thread Seal Tape, Adhesives, Solvent Cement, etc.)
4. Plumbing Fixtures (Taps, Valves, Traps, Water Closets, Sinks, etc.)
5. Pipe Wrench and Spanners
6. Hacksaw
7. Measuring Tape

Theory:

Pipe joints are essential components in plumbing systems that ensure a leak-proof and durable connection between different pipe sections. Plumbing fixtures are devices that receive and discharge water in a controlled manner. Understanding their types and applications is crucial for efficient plumbing system design and maintenance.

Types of Pipe Joints:

1. **Threaded Joint** – Used for metal pipes, sealed with thread seal tape.
2. **Socket or Solvent Welded Joint** – Used for plastic pipes like PVC and CPVC, joined with solvent cement.
3. **Flanged Joint** – Used for large pipes, connected using bolts and gaskets.
4. **Compression Joint** – Used for copper and plastic pipes, tightened with a compression nut.
5. **Brazed or Welded Joint** – Used in metal pipes, requiring high-temperature welding or brazing.
6. **Push-fit Joint** – Used in PPR and some plastic pipes, where fittings are simply pushed into place.

Common Plumbing Fixtures:

1. **Taps/Faucets** – Control water flow.
2. **Valves** – Regulate and control water pressure (Ball valve, Gate valve, Check valve, etc.).
3. **Traps** – Prevent sewer gases from entering buildings (P-trap, S-trap, etc.).
4. **Sinks and Washbasins** – Used for washing purposes.

5. **Water Closets (WC)** – Used in toilets, available in different types (Western, Indian, etc.).
6. **Showers and Bathtubs** – Used in bathrooms.

Procedure:

1. Identification of Pipe Joints:

- Collect different types of pipe joints.
- Observe their structure and method of joining.
- Record their common applications in plumbing systems.

2. Identification of Plumbing Fixtures:

- Examine various plumbing fixtures available in the lab.
- Study their components, function, and installation method.
- Note their materials and standard sizes.

3. Demonstration of Pipe Joining Techniques:

- Perform the solvent welding process on PVC pipes.
- Demonstrate the use of thread seal tape on threaded joints.
- Show how to tighten compression joints and install push-fit connections.
- Discuss the importance of leak testing after making joints.

4. Observation and Analysis:

- Record the jointing technique used for each type of pipe material.
- Analyze the advantages and limitations of each joint type.
- Compare different plumbing fixtures based on function and material.

Precautions:

- Handle sharp tools like hacksaws and pipe wrenches carefully.
- Ensure proper application of sealants to avoid leaks.
- Follow manufacturer instructions while installing plumbing fixtures.
- Wear safety gloves and goggles while working.

Observations and Calculations:

- Identify and list different pipe joints with their applications.
- Compare the durability and ease of installation of various plumbing fixtures.
- Record any issues encountered in the jointing process.

Result:

The study of different types of pipe joints and plumbing fixtures was successfully carried out, and their functions, advantages, and applications were understood.

Conclusion:

This experiment provided hands-on knowledge of pipe joints and plumbing fixtures, which are essential components in water supply and drainage systems. The proper selection and installation of joints and fixtures ensure an efficient and leak-proof plumbing network.

Viva Questions:

1. What are the different types of pipe joints used in plumbing?
2. How is a threaded joint different from a solvent-welded joint?
3. What is the function of a P-trap in plumbing systems?
4. Why are compression joints preferred in certain applications?
5. How can leaks in plumbing joints be prevented?