KG REDDY College of Engineering & Technology
AN AUTONOMOUS INSTITUTION

CELEBRATING 15 YEARS OF BRILLIANCE

Computer Aided Building Drafting Lab

LABORATORY MANUAL

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Department of Civil Engineering

Institute Vision

To become an institution which is internationally recognized for its holistic approach to engineering, innovative teaching and learning culture, research and entrepreneurial ecosystem, and sustainable social impact in the community.

Institute Mission

- To offer undergraduate and post-graduate programs which are supported through industry relevant curriculum and innovative teaching and learning processes that would help students succeed in their professional careers.
- To provide faculty and students with an ecosystem that fosters innovation, research, entrepreneurship, and international exposure through strategic partnerships with government organizations and collaboration with industries.
- To provide holistic learning environment to students which will contribute to their personal and professional growth and enable them to become leaders in their respective fields.
- To contribute to the development of the region by using our technological expertise to work with nearby communities and support them in their social and economic development

Department Vision

To be recognized for excellence in teaching, innovation, and research aimed towards betterment of society through sustainable infrastructural development.

Department Mission

- To integrate innovative teaching and learning practices that will enable students to build technical competence for working in civil engineering industries.
- To encourage innovation, research, and entrepreneurship among faculty and students that will lead to sustainable development.
- To become self-sustainable through strategic collaborations with industries and nearby communities focused on consultancy services.

Program Educational Objectives

- **PEO1:** Graduates will be able to work in multidisciplinary teams focused on development of infrastructure, design, sustainability, construction management and all the other related fields of Civil Engineering.
- **PEO2:** Graduates will be professionally competent through their ability to use modern civil engineering tools and manage projects in leadership positions.
- **PEO3:** Graduates will transform into change makers who will work towards societal development and advocate for equity, social justice, and sustainable development.

Program Outcomes

PO 1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO 2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1, WK2)

PO 3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO 4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis &interpretation of data to provide valid conclusions. (WK8).

PO 5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling, recognizing their limitations to solve complex engineering problems. (WK2 & WK6)

PO 6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for an appeal of sustainability, with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO 7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion, adhere to national & international laws (WK9)

PO 8: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO 10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO 11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i)independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes (PSO's)

PSO1: Graduates will be able to plan, analyze, design safe and sustainable green infrastructure.

PSO2: Graduates will be able to utilize the latest software tools for modeling and simulation in the field of civil engineering.

PSO3: Graduates will be able to work in multidisciplinary teams to design, develop and promote smart construction related.

COMPUTER AIDED BUILDING DRAFTING LAB

Course Objectives: The objectives of this course for the student are to:

1. To Apply provisions of the National Building Code (NBC) for planning buildings.
2. To Identify and interpret various types of conventional signs and brick bonds used in building construction.
3. To Illustrate plan, section, and elevation drawings for doors, trusses,
4. To Utilize AutoCAD tools to generate building plans, sections, and elevations from a given line diagram and specifications.
5. To Prepare working drawings for residential buildings in compliance with building by - laws

Course Outcomes: After completion of this course, the students will be able to

CO1: Apply NBC guidelines to plan and design buildings.

CO2: Demonstrate proficiency in using drafting software commands to construct conventional signs, brick bonds, and building drawings (plans, sections, elevations).

CO3: Design various types of staircases with accuracy.

CO4: Develop complete drawings for single / two - storey residential and public buildings in accordance with building by - laws.

CO5: Prepare detailed electrical and plumbing layouts for residential buildings

Department of Civil Engineering

COMPUTER AIDED BUILDING DRAFTING LAB

Course Code: KG25ACE238 **B. Tech. II Year II - Semester**

LIST OF EXPERIMENTS:

1. Planning Aspects of Building systems as per National Building Code (NBC).
2. Brick bonds: English bond & Flemish bond – Odd and Even courses.
3. Developing plan and section of dog-legged staircase.
4. Developing plan of single storied residential building.
5. Developing section and elevation of single storied residential building.
6. Developing plan of single /two storied Residential building as per Building by-laws.
7. Developing plan of public building as per building by-laws.
8. Developing section and elevation of public building.
9. Development of working drawing of building –Electrical Layout.

MANDATORY INSTRUCTIONS

1. Students should report to the labs concerned as per the timetable.
2. Record should be updated from time to time and the previous experiment must be signed by the faculty in charge concerned before attending the lab.
3. Students who turn up late to the labs will in no case be permitted to perform the experiment scheduled for the day.
4. After completion of the experiment, certification of the staff in-charge concerned in the observation book is necessary.
5. Students should bring a notebook of about 100 pages and should enter the readings/observations/results into the notebook while performing the experiment.
6. The record of observations along with the detailed experimental procedure of the experiment performed in the immediate previous session should be submitted and certified by the staff member in-charge.
7. The group-wise division made in the beginning should be adhered to, and no mix up of student among different groups will be permitted later.
8. The components required pertaining to the experiment should be collected from Lab- in-charge after duly filling in the requisition form.
9. When the experiment is completed, students should disconnect the setup made by them, and should return all the components/instruments taken for the purpose.
10. **Any damage of the equipment or burnout of components will be viewed seriously either by putting penalty or by dismissing the total group of students from the lab for the semester/year.**
11. Students should be present in the labs for the total scheduled duration.

12. Students are expected to prepare thoroughly to perform the experiment before coming to Laboratory.

13. Procedure sheets/data sheets provided to the students groups should be maintained neatly and are to be returned after the experiment.

14. DRESS CODE:
    i. Boys - Formal dress with tuck in and shoes
    ii. Girls - Formal dress
    iii. **Apron for both boys and girls.**

EXPERIMENTS

EXPERIMENT NO. 1

Planning Aspects of Building systems as per National Building Code (NBC)

INTRODUCTION

The National Building Code (NBC) of India is a comprehensive set of guidelines formulated to regulate building construction activities across the country. It serves as a model code for adoption by various agencies such as Public Works Departments, government bodies, local authorities, and private construction firms to ensure safe, healthy, and sustainable built environments.

The NBC provides detailed provisions covering:

- Administrative regulations
- Development control rules
- General building requirements
- Fire and life safety
- Structural design and construction practices
- Building materials
- Plumbing and building services
- Sustainability practices
- Asset and facility management

The primary objective of NBC is to ensure public safety, structural stability, and health of occupants. It enables engineers, architects, and designers to adopt standardized practices while incorporating modern construction techniques.

The code was first published in 1970, revised in 1983, and later updated significantly in 2005 (and further in NBC 2016). These revisions ensure that construction practices remain aligned with technological advancements and safety requirements.

CLASSIFICATION OF BUILDINGS AS PER NBC

Buildings are classified based on occupancy type:

Group	Type of Building	Sub-classifications
Group A	Residential	A-1: Lodging/Rooming Houses A-2: One or Two Family Dwellings A-3: Dormitories A-4: Apartments A-5:

Group	Type of Building	Sub-classifications
		Hotels A-6: Star Hotels
Group B	Educational	B-1: Schools B-2: Training Institutions
Group C	Institutional	C-1: Hospitals C-2: Custodial Institutions C-3: Penal/Mental Institutions
Group D	Assembly	D-1 to D-6, MRTS
Group E	Business	Offices, Banks, Laboratories
Group F	Mercantile	Shops, Markets, Stores
Group G	Storage	G-1: Low Hazard G-2: Moderate G-3: High
Group H	Industrial	Manufacturing Units
Group J	Hazardous	Buildings handling hazardous materials

TYPES OF BUILDINGS

A. Residential Buildings

Buildings where more than 50% of the floor area is used for dwelling purposes.

Examples: Apartments, bungalows, duplex houses, dormitories, hotels.

B. Educational Buildings

Used for educational purposes such as schools, colleges, and training centers**.**

C. Institutional Buildings

Used for medical or custodial care. Examples: Hospitals, prisons, orphanages**.**

D. Assembly Buildings

Places where people gather for social, religious, or recreational activities. **Examples: Theatres, auditoriums, restaurants.**

E. Business Buildings

Used for administrative and professional activities.

Examples: Offices, courts, town halls.

F. Mercantile Buildings

Used for trade and commerce.

Examples: Shops, markets, malls.

G. Industrial Buildings

Used for manufacturing and processing.

Examples: Factories, refineries, mills.

H. Storage Buildings

Used for storage of goods.

Examples: Warehouses, cold storages.

I. Hazardous Buildings

Used for handling explosive or toxic materials.

PROFESSIONALS INVOLVED IN BUILDING PROJECTS

- **Interior Designer**: Enhances interior aesthetics and functionality**.**
- **Quantity Surveyor:** Estimates materials, costs, and prepares BOQ.
- **Landscape Architect:** Designs outdoor spaces.
- **Resident Engineer:** Supervises on-site construction.
- **Structural Engineer:** Designs load-bearing components.
- **Building Services Engineer:** Handles HVAC, lighting, lifts, etc.

CONSTRUCTION MANAGEMENT

Construction management ensures control over:

- **Time**
- **Cost**
- **Quality**

It applies project management techniques across sectors such as:

- **Residential**
- **Commercial**
- **Industrial**
- **Environmental**
- **Infrastructure**

NBC COMPLIANCE CHECK FOR MODEL

a. Height Check

Model height = 7.62 m < 15 m → SAFE (OK)

b. Area Limitations (FAR/FSI)

- FAR = Total Floor Area / Plot Area
- Example:
  Plot Area = 1200 sqft
  FSI = 0.8
  Allowable Built-up Area = 960 sqft
  Model:
- Total Area = 1980 sqft (184 m²)
- 75% Area = 1485 sqft (> 40 m²)
  ✓ Condition Satisfied (OK)

c. Room Sizing

NBC Requirements:

- Minimum 2 habitable rooms
- Single room: ≥ 12.5 m²
- Two-room house:
  - Room 1 ≥ 9.0 m²
  - Room 2 ≥ 6.5 m²
  - Total ≥ 15.5 m²

  Model:
- Master Bedroom = 23 m² (> 12.5 m²)
- Living Room = 42 m² (> 15.5 m²)
  ✓ Condition Satisfied (OK)

d. Wall Height

NBC Requirement:

- Minimum height = 2.75 m
  Model:
- Wall height = 3 m
  ✓ Condition Satisfied (OK)

e. Wall Thickness (Fire Safety)

- Main wall = 230 mm (9")
- Inner wall = 110 mm (4.5")
  NBC Requirement: ≥ 100 mm

  ✓ Condition Satisfied (OK)

f. PASSAGEWAY REQUIREMENTS (NBC STANDARDS)

Passageways and corridors are essential for safe movement and emergency evacuation. NBC specifies minimum widths based on building type and occupancy.

Standard Passageway Requirements

Type of Building	Minimum Width of Corridor/Passage
Residential Buildings	1.0 m
Educational Buildings	1.5 m
Institutional Buildings (Hospitals)	2.0 m
Assembly Buildings	1.5 – 2.0 m
Hotels	1.5 m
Industrial Buildings	1.2 m

Key Guidelines

- Passageways should be well-lit and ventilated.
- They must be free from obstructions at all times.
- In case of emergency, they should allow smooth evacuation of occupants.
- For high-occupancy buildings, wider corridors are recommended.
- Handrails should be provided where necessary for safety.

✓ Conclusion for Model:

Based on NBC provisions for height, area, room size, wall thickness, and passageways, the model satisfies all required conditions and is considered safe and compliant.

Table 2 Masonry Walls: Solid (Required to Resist Fire from One Side at a Time)

(*Clause* 3.3.2)

Sl No.	Nature of Construction and Materials	Minimum Thickness (mm), Excluding any Finish for a Fire Resistance (Hours) of									
		Load Bearing					Non-load Bearing				
		1	1½	2	3	4	1	1½	2	3	4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	Reinforced[1] cement concrete	120 (25)[2]	140 (25)[2]	160 (25)[2]	200 (25)[2]	240 (25)[2]					
ii)	Unreinforced cement concrete	150	175	—	—	—					
iii)	No-fines concrete with :										
	a) 13 mm cement/sand or gypsum/sand	—	—	—	—	—	150	150	150	150	150
	b) 13 mm light weight aggregate gypsum plaster	—	—	—	—	—	150	150	150	150	150
iv)	Bricks of clay:										
	a) Without finish	90	100	100	170	170	75	90	100	170	170
	b) With 13 mm lightweight aggregate gypsum plaster	90	90	90	100	100	75	90	90	90	100
v)	Bricks of sand lime:										
	a) Without finish	90	100	100	190	190	75	90	100	170	170
	b) With 13 mm lightweight aggregate gypsum plaster	90	90	90	100	100	75	90	90	90	100
vi)	Blocks of concrete:										
	a) Without finish	90	100	100	—	—	75	90	100	140	150
	b) With 13 mm lightweight aggregate gypsum plaster	90	90	90	100	100	75	75	75	90	100
	c) With 13 mm cement/sand or gypsum/ sand						75	90	90	100	140
vii)	Blocks of lightweight concrete:										
	a) Without finish	90	100	100	140	150	75	75	75	125	140
	b) With 13 mm lightweight aggregate gypsum plaster	90	90	90	100	100	50	63	75	75	75
	c) With 13 mm cement/sand or gypsum/ sand	—	—	—	—	—	75	75	75	90	100
viii)	Blocks of aerated concrete:										
	a) Without finish	90	100	100	140	180	50	63	63	75	100
	b) With 13 mm lightweight aggregate gypsum plaster	90	90	100	100	150					

[1] Walls containing at least 1 percent of vertical reinforcement.

[2] Minimum thickness of actual cover to reinforcement.

Masonry Walls – Fire Resistance Requirements (NBC Clause 3.3.2)

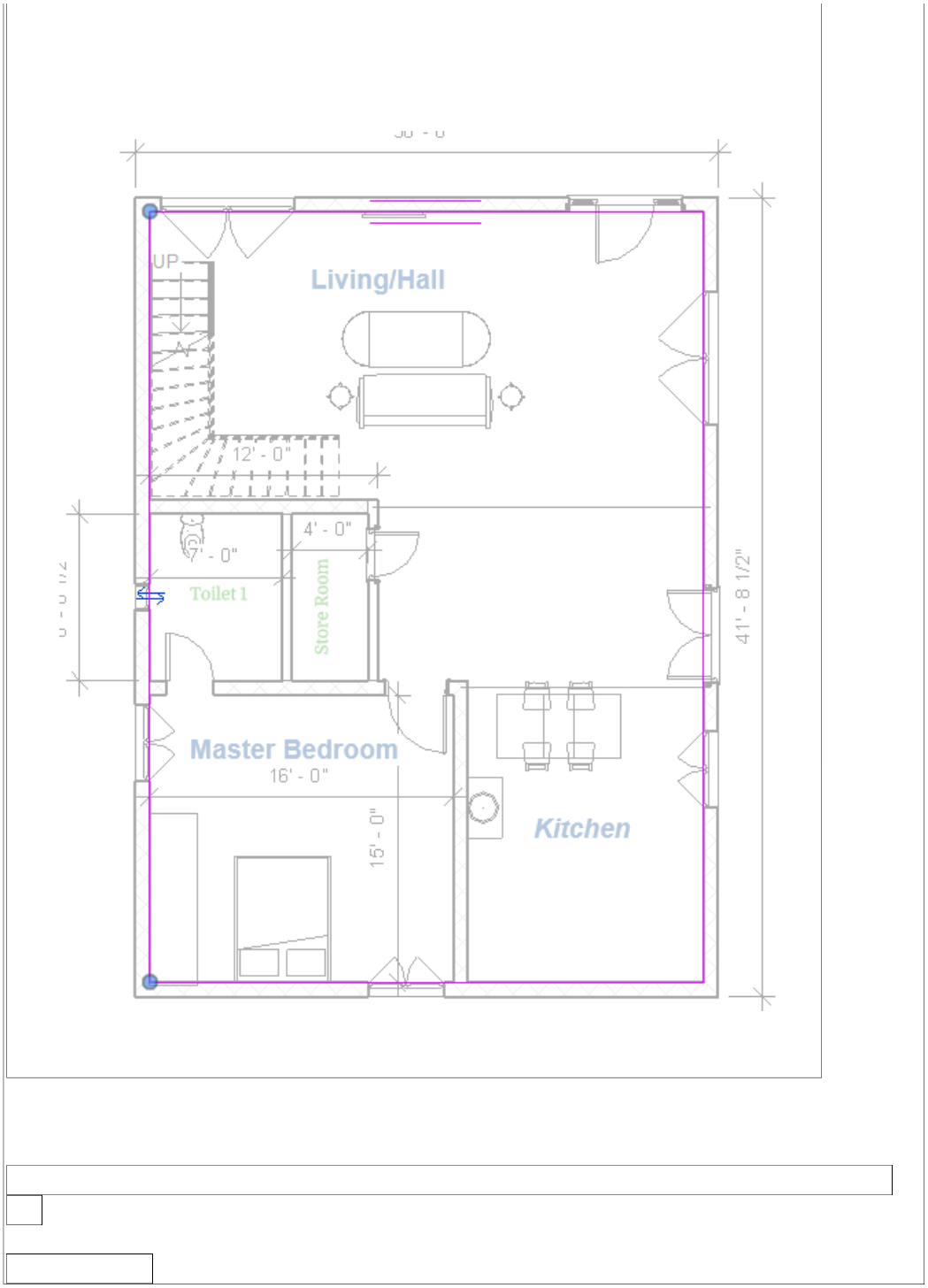
Table Description in Simplified Tabular Form

Sl. No.	Type of Material	Condition	Wall Type	Fire Resistance (Hours)	Minimum Thickness (mm)
1	Reinforced Cement Concrete	—	Load-bearing	1 – 4 hrs	120 – 240
2	Unreinforced Cement Concrete	—	Load-bearing	1 – 1.5 hrs	150 – 175
3	No-fines Concrete	With plaster	Non-load-bearing	1 – 4 hrs	150
4	Clay Bricks	Without finish	Load-bearing	1 – 4 hrs	90 – 170
		With plaster	Load-bearing	1 – 4 hrs	90 – 100
		Without finish	Non-load-bearing	1 – 4 hrs	75 – 170
		With plaster	Non-load-bearing	1 – 4 hrs	75 – 100
5	Sand-Lime Bricks	Without finish	Load-bearing	1 – 4 hrs	90 – 190
		With plaster	Load-bearing	1 – 4 hrs	90 – 100
		Without finish	Non-load-bearing	1 – 4 hrs	75 – 170
		With plaster	Non-load-bearing	1 – 4 hrs	75 – 100
6	Concrete Blocks	Without finish	Load-bearing	1 – 2 hrs	90 – 100
		With plaster	Load-bearing	1 – 4 hrs	90 – 100
		Without	Non-load-	1 – 4 hrs	75 – 150

		finish	bearing		
		With plaster	Non-load-bearing	1 – 4 hrs	75 – 100
7	Lightweight Concrete Blocks	Without finish	Load-bearing	1 – 4 hrs	90 – 150
		With plaster	Load-bearing	1 – 4 hrs	90 – 100
		Without finish	Non-load-bearing	1 – 4 hrs	75 – 140
		With plaster	Non-load-bearing	1 – 4 hrs	50 – 75
8	Aerated Concrete Blocks	Without finish	Load-bearing	1 – 4 hrs	90 – 180
		With plaster	Load-bearing	1 – 4 hrs	90 – 150
		Without finish	Non-load-bearing	1 – 4 hrs	50 – 100

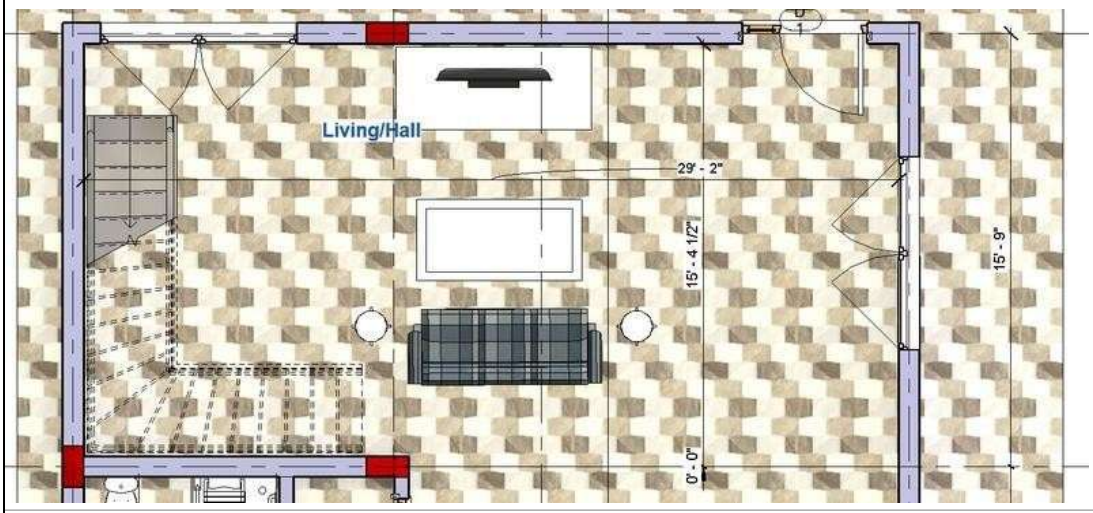
The height of my model in Week 4/ Project 1 is 7.62m <

b. Area



The area of my model is 1980sqft(184m^2), 75%of the area is 1485 sqft(138m^2) >40m^2, Hence Ok.

c. Room sizing



My model rooms

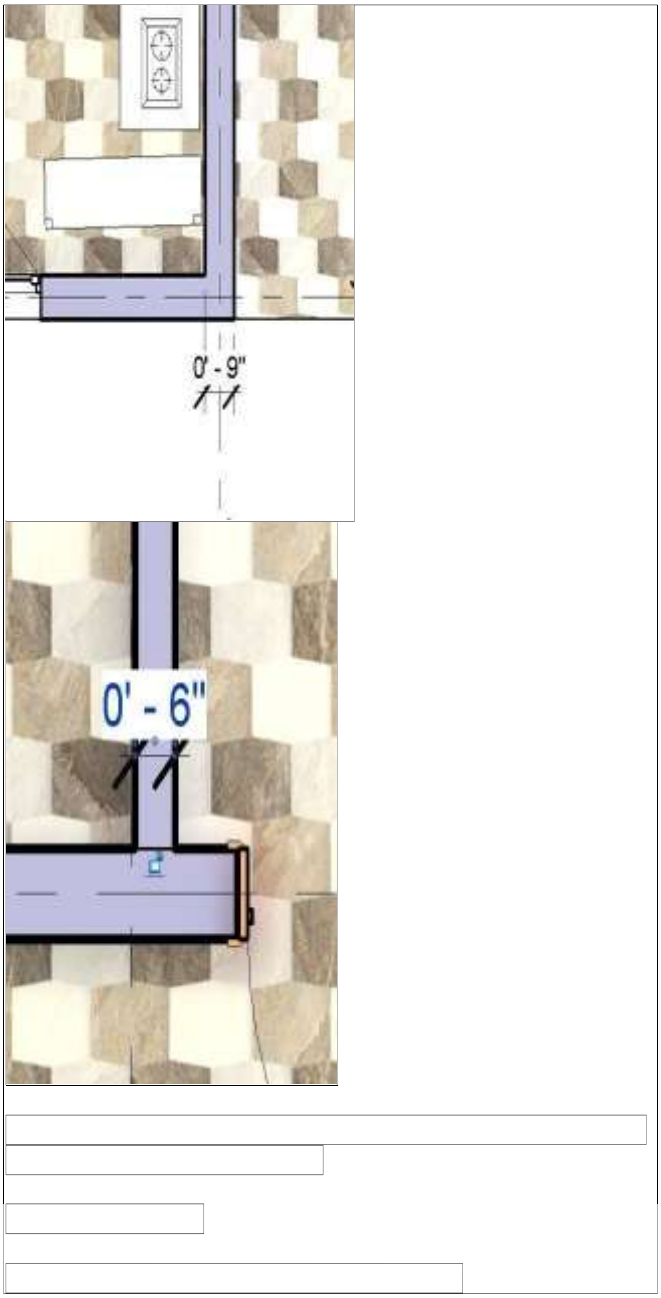
	Master bedroom is 4.5m(>2.6)X4.6m= 23m^2 >12.5$m^2$5m^2
	Living Room is 8.9(>6.5m)X4.5= 42m^2 > 15.5m^2

Both conditions are satisfied Hence Ok	

d. Wall height

All the walls in my model are 3m height> 2.75, Hence Ok

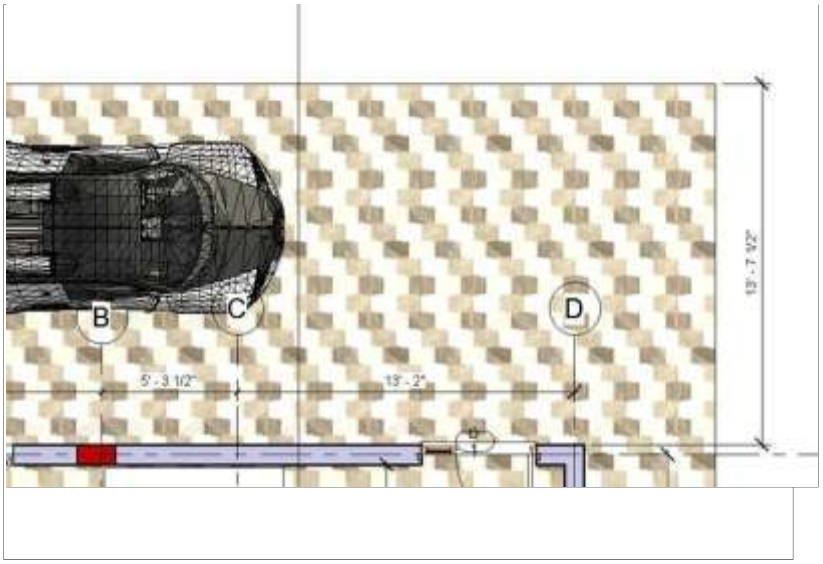
e. Thickness based on fire life and safety



In the model thickness of the Main Wall is 9" (i.e. 230mm) and Inner Wall 4.5"(110mm) > 100 for Brick of concrete NBC Value, Hence Okay

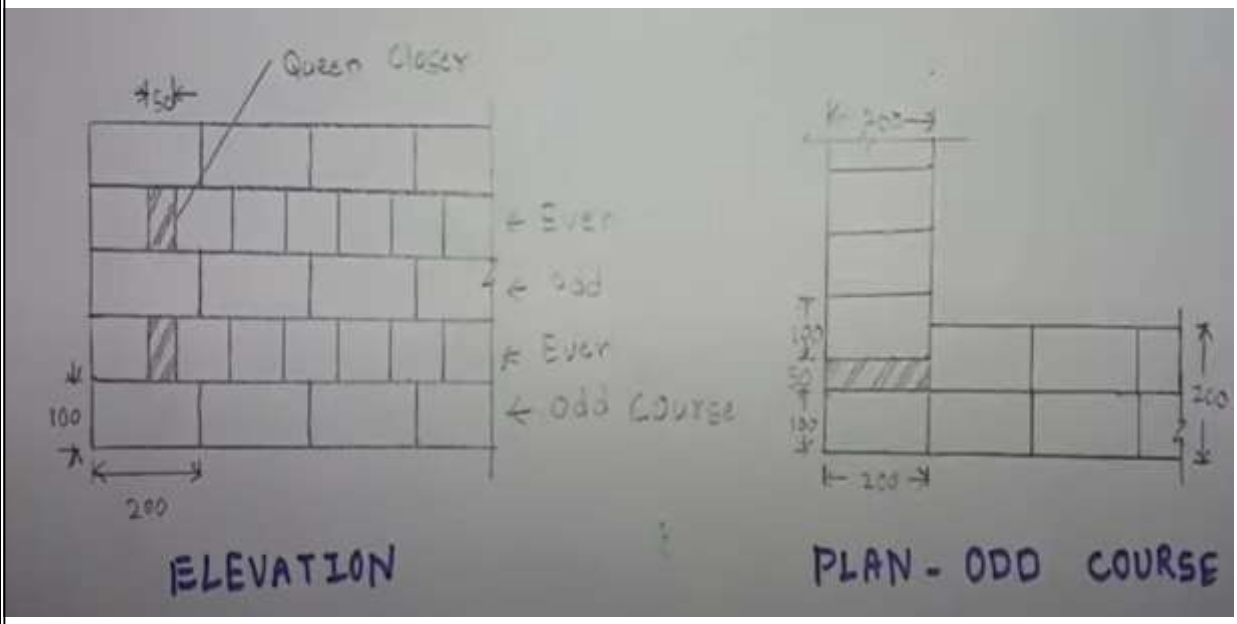
f. Passageway requirements

For my model, Approach Road is 6" (2m approx.)>1.5m, Hence Ok.

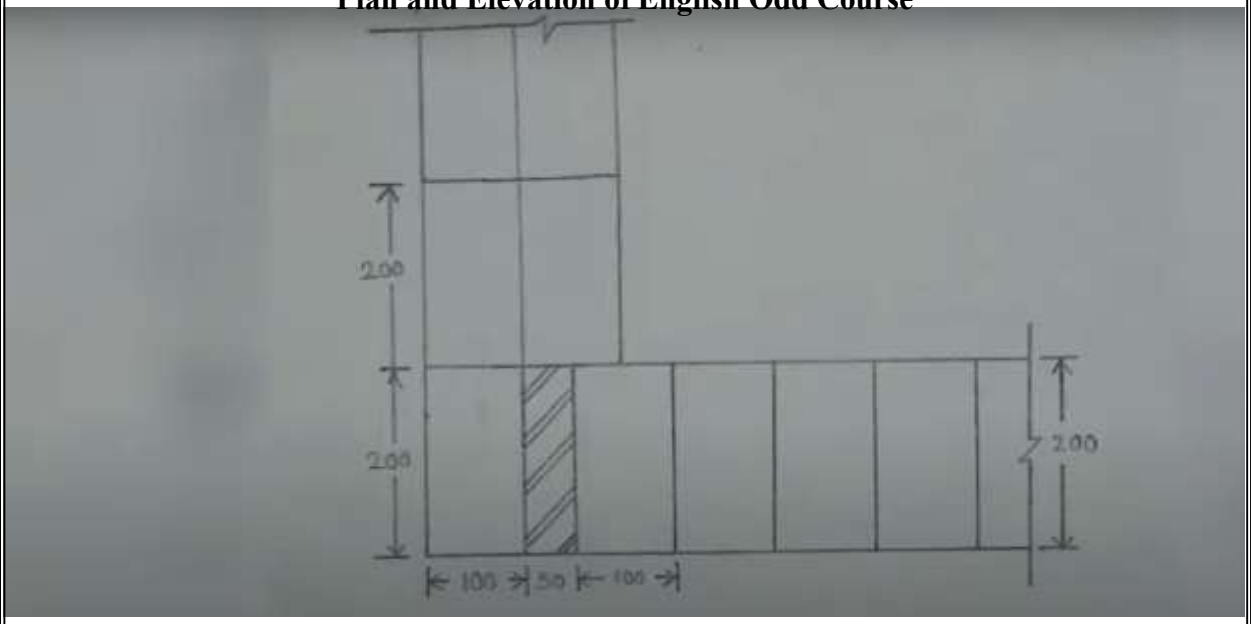

B
C
D
5' - 3 1/2"
13' - 2"
13' - 7 1/2"

Experiment-2

Brick bonds: English bond & Flemish bond – Odd and Even Courses



Plan and Elevation of English Odd Course



Plan and Elevation of English Bond Even Course

1. Aim

To create the drawing of English Bond and Flemish Bond showing odd and even courses using AutoCAD commands.

2. Software Used

- AutoCAD (Computer Aided Drafting Software)

3. Procedure

A. Steps to Draw English Bond

1. Start the software

o Open AutoCAD and select New Drawing.

2. Set Units

- Command: **UNITS**
- Set the units to **millimeters**.

2. ***Draw the First Brick (Header)***

- Command: **RECTANGLE**
- Draw a rectangle representing the brick size (e.g., 190 mm × 90 mm).

3. ***Create Multiple Bricks***

- Command: **COPY**
- Copy the brick horizontally to create a **header course (odd course)**.

4. ***Create Even Course (Stretcher Course)***

- Command: **RECTANGLE**
- Draw a brick of size **190 mm × 90 mm** representing a **stretcher**.
- Command: **COPY**
- Copy the stretcher bricks along the length.

5. ***Create Alternate Courses***

- Command: **OFFSET**
- Offset the first course vertically (e.g., 100 mm) to create the next course.

6. ***Arrange Bond Pattern***

- Command: **MOVE**

- Adjust bricks so that headers and stretchers alternate in successive courses.

7. ***Add Brick Joint Lines***
   - Command: **LINE**
   - Draw mortar joint lines if required.
8. ***Trim Extra Lines***
   - Command: **TRIM**
   - Remove unwanted overlapping lines.
9. ***Label the Courses***

- Command: **TEXT** or **MTEXT**
- Label **Odd Course (Header Course)** and **Even Course (Stretcher Course)**.
-

B. Steps to Draw Flemish Bond

1. **Draw Brick Shape**
   - Command: **RECTANGLE**
   - Draw a standard brick dimension.
2. ***Create Header and Stretcher***
   - Command: **COPY**
   - Place **one header and one stretcher alternately** in the same course.
3. ***Create the Next Course***
   - Command: **OFFSET**
   - Offset the first course vertically.
4. ***Adjust Alternate Arrangement***
   - Command: **MOVE**
   - Ensure **headers are placed centrally over stretchers** in the next course.
5. ***Use Mirror for Symmetry***
   - Command: **MIRROR**

- Mirror bricks where necessary to maintain the bond pattern.

6. ***Remove Unwanted Portions***
   - Command: **TRIM**
7. ***Add Labels***
   - Command: **TEXT / MTEXT**
   - Label **Odd Course** and **Even Course**.

1. ***Commands Used***

- **UNITS** – Set drawing units
- **RECTANGLE** – Draw brick shapes
- **LINE** – Draw mortar joints
- **COPY** – Duplicate bricks
- **OFFSET** – Create parallel courses
- **MOVE** – Adjust brick position
- **MIRROR** – Create symmetrical bricks
- **TRIM** – Remove extra lines
- **TEXT / MTEXT** – Add annotations

2. ***Result***

The drawings of **English Bond** and **Flemish Bond** with **odd and even courses** were successfully created using AutoCAD commands.

Experiment-3

Developing plan and section of dog - legged staircase.

Aim

To develop a detailed architectural plan and section view of a dog-legged staircase using AutoCAD, including dimensions and construction details to ensure accurate and practical design
implementation.

Software Used

- **AutoCAD**: A CAD software for creating detailed 2D and 3D drawings.

Procedure

1. Preparation and Setup

- **Launch AutoCAD**: Open AutoCAD and start a new drawing.
- **Set Units**: Configure the drawing units to architectural or decimal, based on your project requirements.
- **Layer Management**: Create and organize layers for different components (e.g., stairs, dimensions, text).

2. Drawing the Plan of the Dog-Legged Staircase

- **Define Dimensions**: Establish the dimensions for the staircase, including width, rise, and run. A typical dog-legged staircase includes two flights with a landing between them.
  - **Draw the Plan View**:
    - **Flight Layout**: Use the LINE command to draw the outline of the two flights and the landing in a top-down view.
    - **Landing**: Represent the landing as a rectangle or square depending on its size.
    - **Treads and Risers**: Sketch the treads and risers for each flight of stairs, showing the change in direction where the staircase "dog-legs" at the landing.
    - **Handrails and Balustrades**: Add symbols for handrails and balustrades if needed.
- **Insert Dimensions**: Use the DIMLINEAR or DIMCONTINUE commands to add dimensions to the drawing, including widths, rises, and runs.

Result Example:

3. Drawing the Section of the Dog-Legged Staircase

- **Create a Section View**: To visualize the vertical dimensions and construction details, draw a section through the staircase.
  - **Draw the Section**:
    - **Outline**: Use the LINE and ARC commands to represent the vertical profile of the staircase, including treads, risers, and landing.
    - **Risers and Treads**: Clearly show the height and depth of each tread and riser.
    - **Construction Details**: Include details such as the thickness of steps, construction materials, and any supports.
- **Add Dimensions**: Use the DIMLINEAR command to add vertical dimensions for the risers and overall height of the staircase.

Result Example:

4. Adding Annotations and Details

- **Text Annotations**: Use the TEXT or MTEXT command to label different parts of the staircase, such as "Landing", "Flight 1", and "Flight 2".
- **Construction Notes**: Include notes on materials, finishes, and any specific construction details or instructions.

Result Example:

5. Finalizing the Drawing

- **Check Accuracy**: Review the drawings to ensure all dimensions are correct and that the design adheres to building codes.
- **Layer Control**: Make sure all layers are properly managed and visible according to the final presentation requirements.
- **Plotting and Printing**: Set up the drawing for printing, ensuring the scale and layout are appropriate for physical copies or digital sharing.

Result

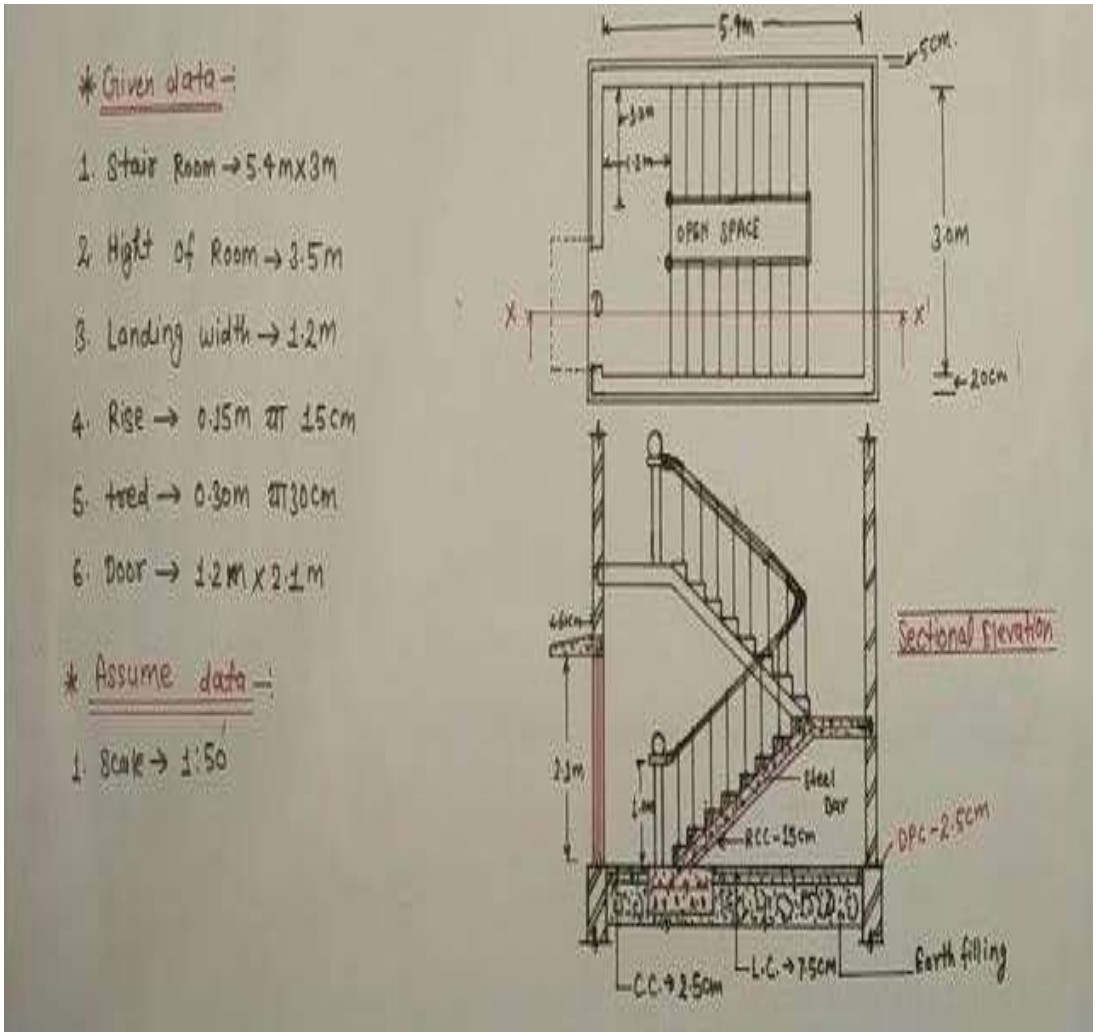
The result of the experiment will be a set of detailed AutoCAD drawings that include:

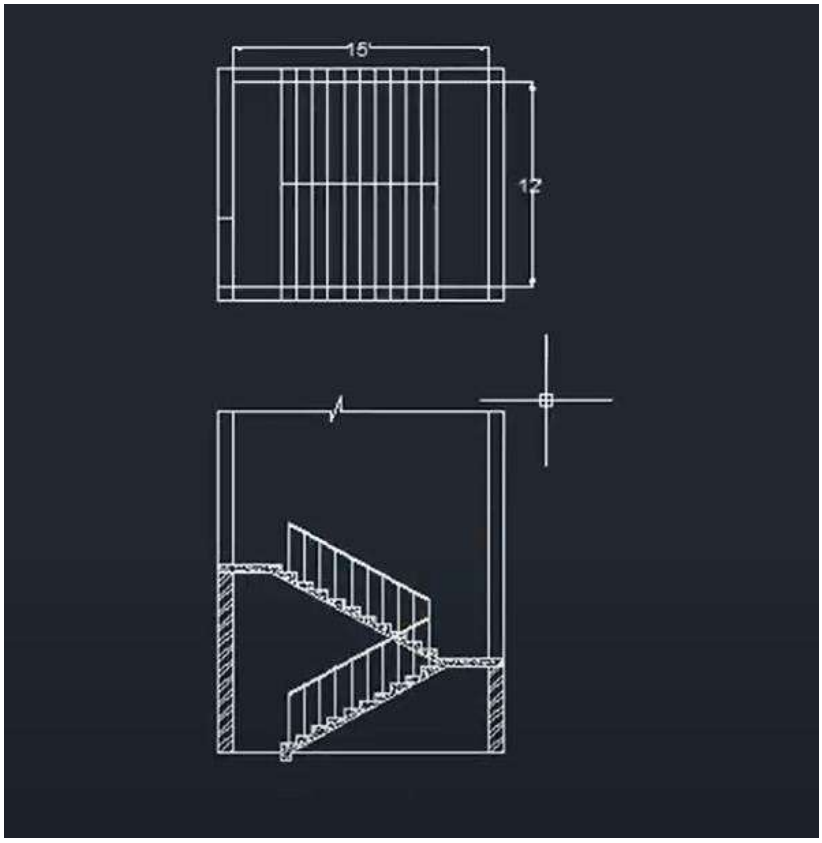
1. **Plan View**:
   - **Top-Down Layout**: Clear representation of the staircase layout, including flights and landing.

- **Dimensions**: Accurate dimensions of treads, risers, landing, and overall width.

2. **Section View**:
    - **Vertical Profile**: Detailed section showing the staircase's profile, including the height of risers and depth of treads.
    - **Construction Details**: Specific construction details like tread thickness and riser height.
3. **Annotations and Details**:
    - **Labels and Notes**: Text annotations explaining different parts of the staircase and any additional construction instructions.
4. **Finalized Drawings**:
    - **Complete Set**: Well-organized drawings ready for construction use or client presentation.

These drawings will help in understanding the design and construction of the dog-legged staircase, ensuring it is built to specification and fits within the intended space.


* Given data :-
1. Stair Room → 5.4m x 3m
2. Hight of Room → 3.5m
3. Landing width → 1.2m
4. Rise → 0.15m or 15cm
5. tread → 0.30m or 30cm
6. Door → 1.2m x 2.1m
* Assume data :-
1. Scale → 1:50
5.4m
5cm
0.3m
1.2m
OPEN SPACE
3.0m
X
X'
20cm
Sectional Elevation
2.1m
1.2m
Steel Door
RCC-15cm
DPC-2.5cm
C.C.→2.5cm
L.C.→7.5cm
Earth filling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12


Baluster
Handrail
Newel post
Soffit
Waist
Nosing
Scotia
Step
Trade
Rise
Going
Flight
Landing
Headroom
Pitch or slope
Riser
Line of nosing
String or Stringers

Experiment-4

Developing plan of single storied residential building.

Aim

To develop a detailed architectural plan for a single-story residential building using AutoCAD. This includes creating a floor plan, incorporating essential elements like rooms, doors, windows, and furniture, and ensuring the design meets standard architectural and structural requirements.

Software Used

- AutoCAD 2024: A computer-aided design (CAD) software used for creating precise 2D and 3D drawings.

Procedure

1. Preparation and Setup

- Launch AutoCAD: Open AutoCAD and set up a new drawing.
- Units and Scale: Set the drawing units to architectural or decimal, depending on preference. Adjust the scale according to the project requirements.

2. Creating the Floor Plan

- **Drawing the Outline**
  - Use the RECTANGLE or LINE command to draw the perimeter of the building.
  - Define the external dimensions based on the architectural requirements.
- **Adding Internal Walls**
  - Use the LINE command to draw internal walls. Specify the thickness according to building codes (e.g., 4" or 6" thick).
  - Utilize the OFFSET command to create parallel walls and maintain consistent wall thickness.
- **Placing Doors and Windows**
  - Insert doors using the DOOR block or draw them using the RECTANGLE command and trim excess walls with TRIM.

- Place windows similarly, ensuring they are positioned for optimal natural light and ventilation.

- **Designating Rooms**
  - Label rooms using the TEXT or MTEXT command. For example, label rooms as Living Room, Kitchen, Bedroom, etc.
- **Adding Fixtures and Furniture**
  - Use blocks or symbols from the AutoCAD library to place fixtures like sinks, stoves, and furniture in their respective locations.
- **Adding Dimensions and Annotations**
  - Use the DIMLINEAR or DIMCONTINUE commands to add dimensions to your drawing.
  - Annotate the drawing with text to indicate room names, dimensions, and any other relevant information.

3. Refining the Design

- **Layer Management**
  - Use layers to organize different elements of the drawing (e.g., walls, doors, furniture).
  - Control the visibility and properties of each layer for better clarity.
- **Adjusting Line Types and Weights**
  - Modify line types and weights to distinguish between different elements (e.g., walls vs. furniture).
- **Checking for Errors**
  - Use the CHECK and OVERKILL commands to find and correct any drawing errors or inconsistencies.

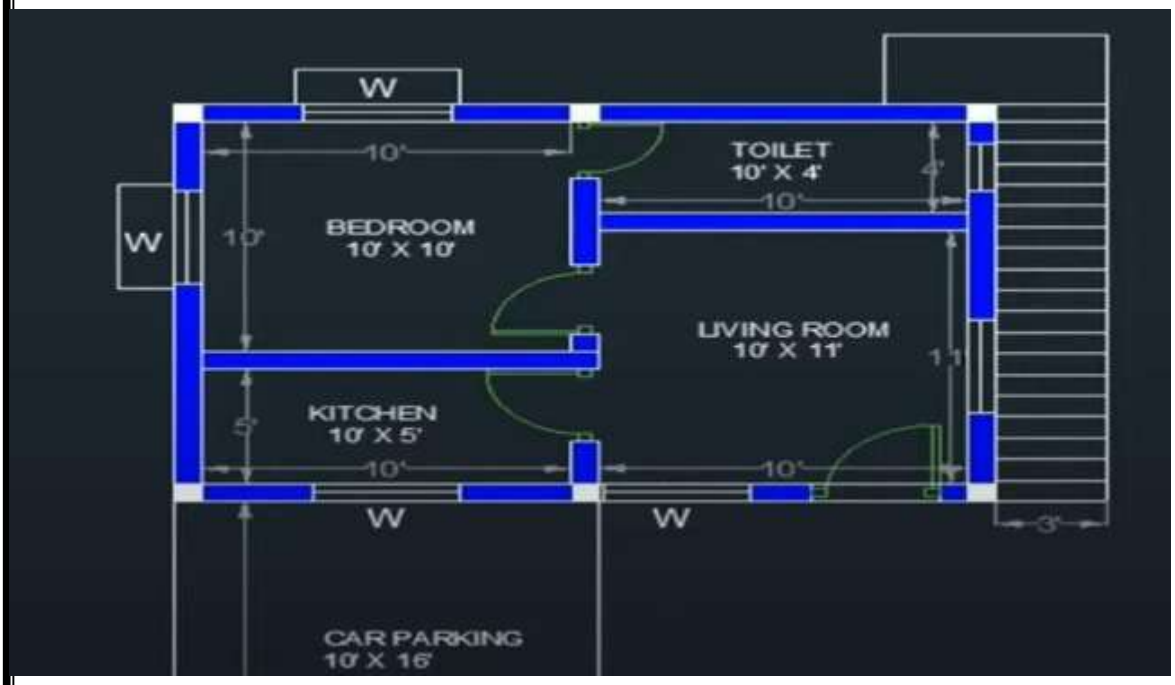
4. Finalizing the Drawing

- **Plotting and Printing**
  - Set up the layout for printing. Configure paper size, scale, and plot area.
  - Use the PLOT command to generate a PDF or physical copy of the floor plan.

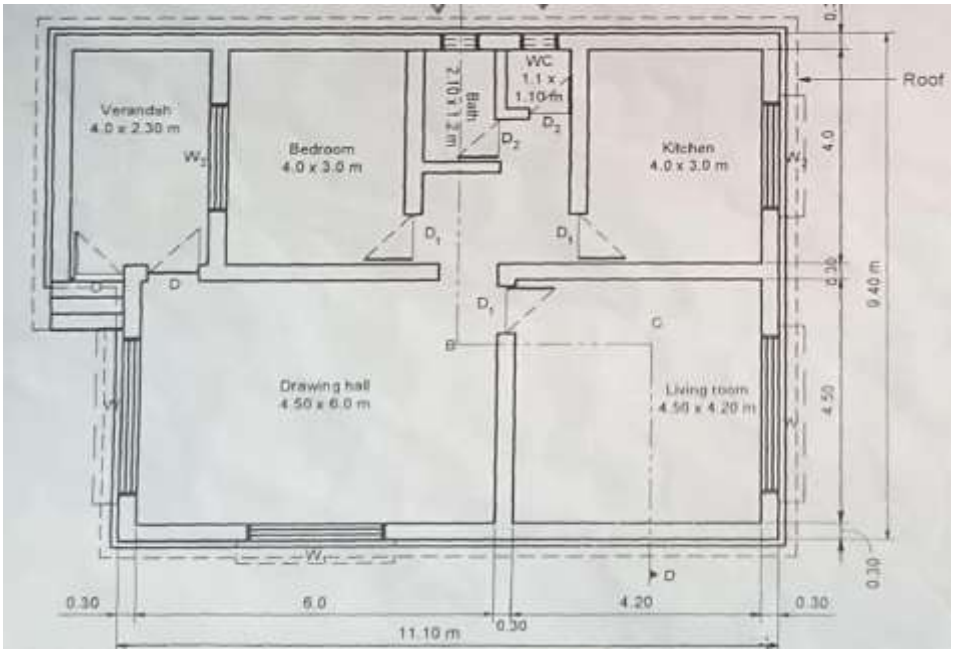
- **Saving and Exporting**
  - Save the drawing in the AutoCAD native format (.dwg).
  - Export to other formats if required, such as .pdf for sharing with clients or contractors.

Results

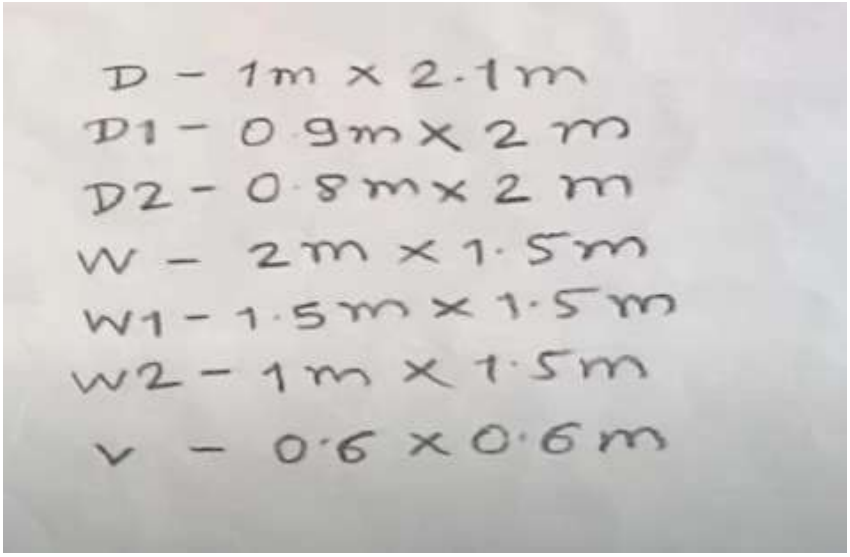
Drafted a Single-story residential building plan



Example floor plan showing room layout, doors, and windows



Plan of Single Storied Building



Dimensions of Single Storied Building

Experiment-5

Developing section and elevation of single storied Residential building.

Aim

To create accurate and detailed sections and elevations of a single-storied residential building using AutoCAD, showcasing architectural features, dimensions, and materials.

Software Used

- AutoCAD (any version that supports 2D drawing)
- Optional: AutoCAD Architecture or any specific architectural plugins for enhanced features.

Procedure for Implementation in AutoCAD Step 1: Set Up Your Drawing Environment

1. Open AutoCAD: Launch AutoCAD and create a new drawing.
2. Set Units: Type UNITS in the command line and set the appropriate units (e.g., meters or feet).
3. Set Limits: Type LIMITS, and specify the drawing limits (e.g., 0,0 to 20,20) according to your building's size.
4. Grid and Snap: Enable grid and snap settings for precise drawing (type GRID and SNAP commands).

Step 2: Create the Floor Plan

1. Draw the Outline: Use the LINE or POLYLINE command to draw the perimeter of the building based on your architectural design.
2. Add Walls: Use the OFFSET command to create wall thickness around the outline.
3. Insert Doors and Windows: Use the RECTANGLE and CIRCLE commands to represent doors and windows. Specify their sizes according to your design.
4. Label Spaces: Use the TEXT command to label different rooms and spaces in the plan.

Step 3: Generate Sections

1. Determine Section Locations: Identify where you want to create the sections (e.g., A-A, B-B) based on your floor plan.
2. Draw Section Lines: Use the LINE command to draw section cut lines on the floor plan.
3. Create Section View: In a new layer, replicate the interior layout vertically to create a section view. Use HATCH for materials (e.g., bricks, concrete) and label features (e.g., beams, columns) with the TEXT command.
4. Add Dimensions: Use the DIMLINEAR and DIMCONTINUE commands to dimension the section, indicating heights and levels.

Step 4: Generate Elevations

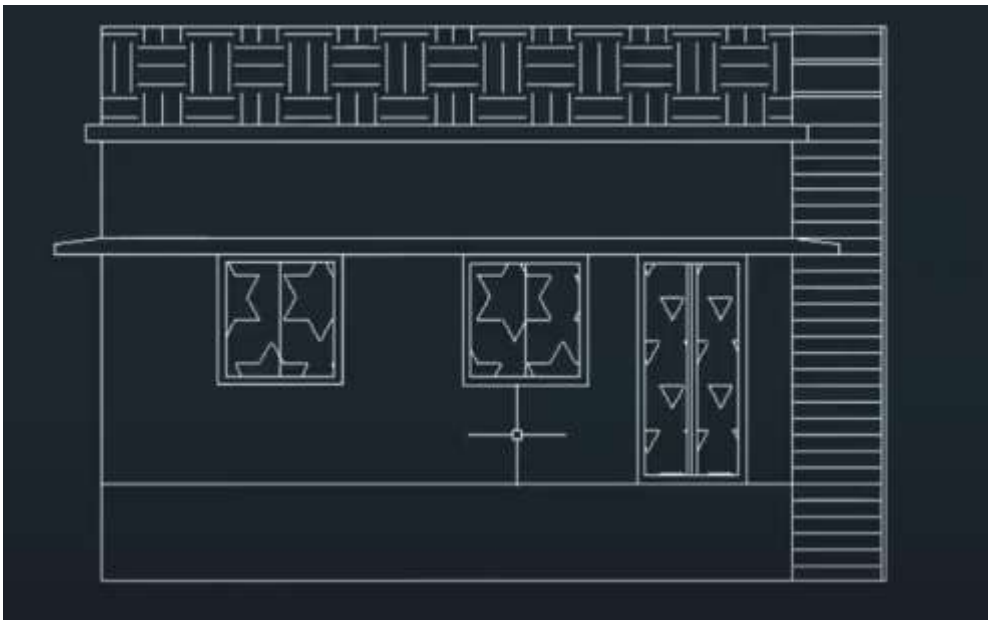
1. Identify Elevation Views: Decide on the elevations to draw (e.g., front, rear, left, right).
2. Draw Elevations: Starting from the floor plan, sketch the elevations based on the building's height and facade design. Use vertical lines to indicate walls and heights.
3. Add Features: Include doors, windows, roofs, and other architectural elements, using appropriate symbols and hatch patterns.
4. Dimension Elevations: Use the DIMLINEAR command to dimension the elevations.

Step 5: Finalize Drawings

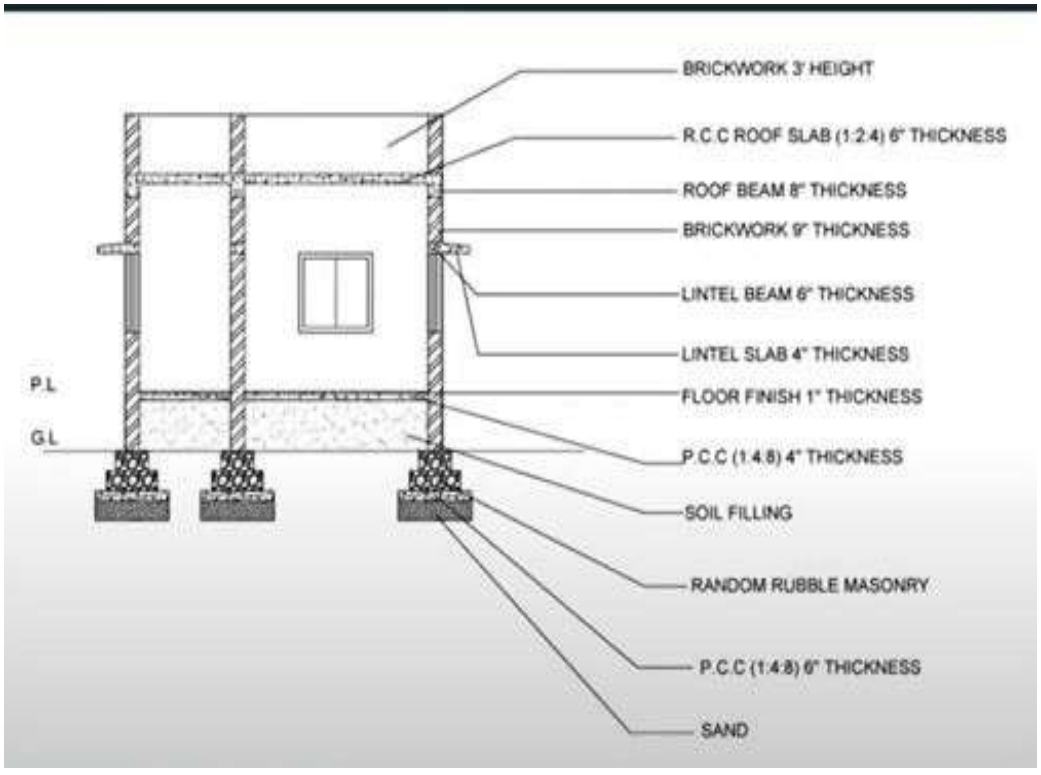
1. Layer Management: Organize your drawing using layers (e.g., walls, dimensions, text) for clarity.
2. Annotations: Add notes, material specifications, and details for clarity using the TEXT command.
3. Review and Edit: Check for accuracy, alignment, and completeness. Make necessary adjustments.
4. Save Your Work: Use SAVEAS to save your drawing in the desired format (DWG, PDF).

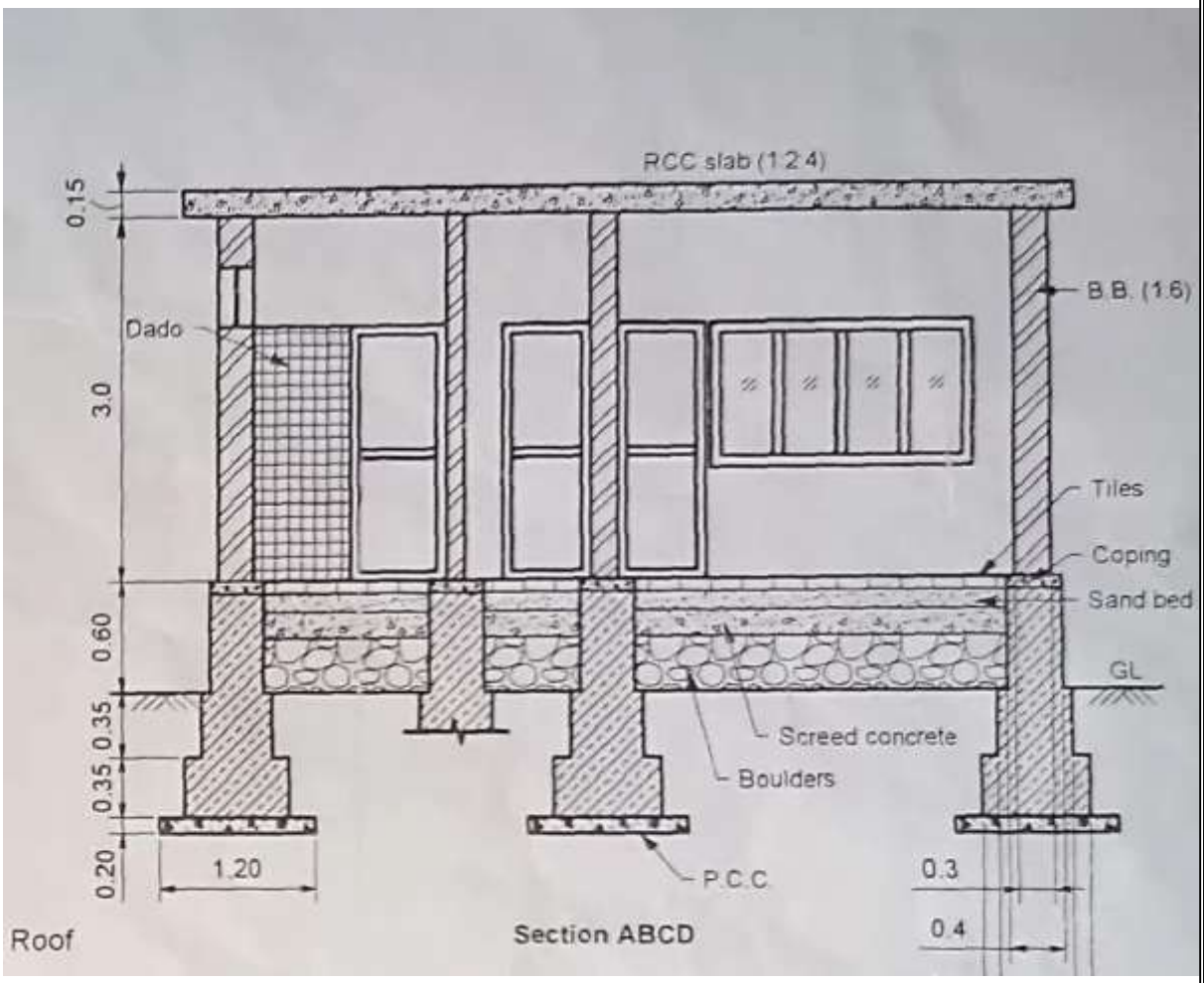
Results

- Drawings: You will have detailed sections and elevations that accurately represent the single-storied residential building.
- Dimensions and Annotations: The drawings will include dimensions and annotations that provide essential information for construction.
- Presentation: The final drawings can be printed or exported for presentations or further analysis

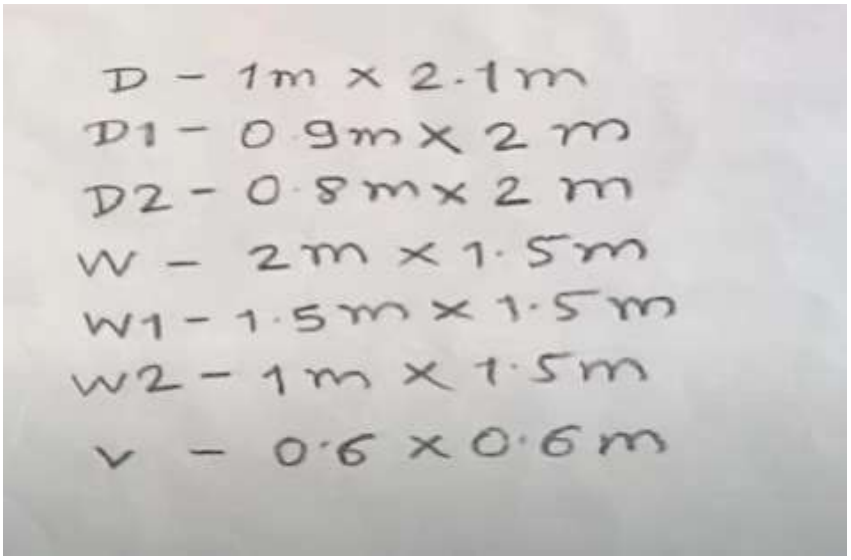


a) Elevation view

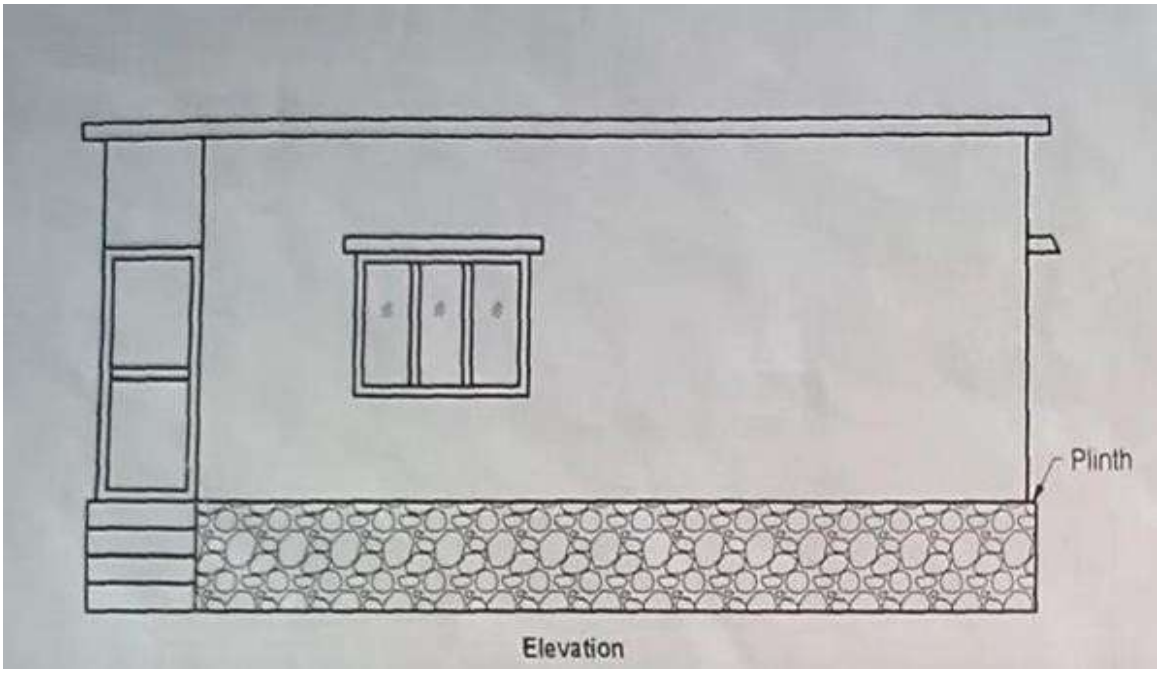




b) Sectional View



Dimensions



c) Elevation

Experiment-6

Developing plan of single /two storied Residential building as per Building

Aim

To create the plan of a single or two-storied residential building in AutoCAD, ensuring compliance with building by-laws such as setbacks, height restrictions, and floor area ratio (FAR).

Software Used

- **AutoCAD**

Procedure for Implementation in AutoCAD Step 1: Understanding the Building By-Laws

1. **Collect By-Law Information**: Gather the necessary building by-laws for your area. These may include:
    - Setback requirements (front, side, rear).
    - Maximum permissible height for a building.
    - Floor area ratio (FAR).
    - Ground coverage and open space requirements.
    - Parking provisions, ventilation, and lighting regulations.
2. **Verify Plot Size**: Ensure you have the correct plot size (e.g., 30' x 40', 50' x 80', etc.) for which you will develop the plan.

Step 2: Setting Up the Drawing Environment

1. **Open AutoCAD**: Launch AutoCAD and start a new drawing.
2. **Set Units**: Type UNITS in the command line and set the units (e.g., meters or feet).
3. **Set Limits**: Use the LIMITS command to define the drawing space, depending on the plot dimensions (e.g., 0,0 to 50,80 for a 50'x80' plot).
4. **Enable Grid and Snap**: Activate grid and snap settings (using GRID and SNAP commands) to maintain precision in drawing.

Step 3: Plotting the Site Plan

1. **Draw Plot Boundaries**: Use the LINE or RECTANGLE command to draw the boundary of the plot as per the specified dimensions (e.g., 30'x40').
2. **Apply Setbacks**: Based on the by-laws, use the OFFSET command to apply the required setbacks (e.g., front, rear, and side setbacks of 3' or 5' as applicable).
3. **Define Open Areas**: Ensure that sufficient open spaces, parking areas, and green spaces (as per by-laws) are designated.

Step 4: Creating the Floor Plan

1. **Draw the Building Outline**: Use the LINE or POLYLINE command to draw the main structure within the setback area, ensuring it fits the available space.
2. **Design Rooms**: Subdivide the structure into different rooms, such as living room, kitchen, bedrooms, bathrooms, etc., by drawing internal walls using the LINE or OFFSET commands. Ensure that room dimensions comply with building standards for minimum sizes.
3. **Add Doors and Windows**: Use RECTANGLE and CIRCLE commands to insert doors and windows at appropriate locations, ensuring compliance with ventilation and lighting regulations.
4. **Add Stairs (for Two-Storied Building)**: For a two-storied building, draw the staircase in a designated location, considering space efficiency and by-law restrictions on stair placement.
5. **Label Rooms**: Use the TEXT command to label each room (e.g., Bedroom, Kitchen, etc.).

Step 5: Adding Architectural Elements

1. **Add Furniture Layouts** (Optional): Use AutoCAD blocks or create your own for common furniture (e.g., beds, tables, sofas) to show furniture layouts in each room.
2. **Insert Plumbing and Electrical Features**: Add symbols for sinks, toilets, and electrical points if required.

Step 6: Adding Annotations and Dimensions

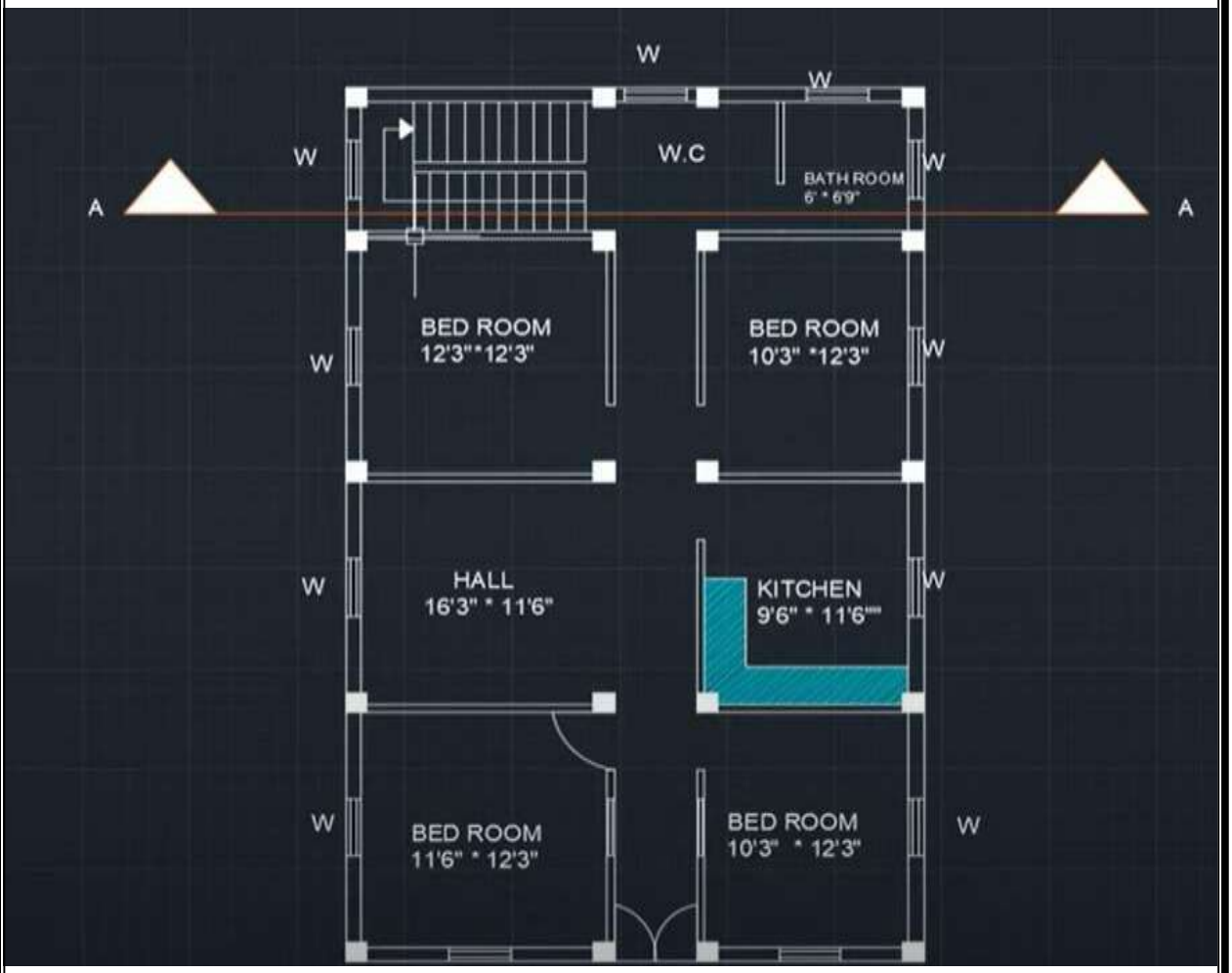
1. **Dimensions**: Use the DIMLINEAR command to dimension the rooms, doors, windows, and setbacks.
2. **Text Annotations**: Use the TEXT command to annotate important elements like room names, total plot area, and building area.
3. **By-Law Compliance**: Include notes on the drawing stating compliance with specific building by-laws, such as setbacks and FAR.

Step 7: Layer Management and Final Touches

1. **Organize Layers**: Create separate layers for walls, doors, windows, dimensions, furniture, etc., for easier management and clarity.
2. **Final Edits and Review**: Review the drawing for completeness and accuracy. Check if all elements comply with the building by-laws.
3. **Save the File**: Save your work using the SAVEAS command in the desired format (DWG, DXF, or PDF).

Results

- **Plan of Residential Building**: A detailed 2D plan of the single/two- storied residential building, showing rooms, doors, windows, and other architectural elements.
- **By-Law Compliance**: The drawing will comply with the local building by-laws, including setbacks, height restrictions, and FAR.
- **Dimensions and Annotations**: The plan will include all necessary dimensions, annotations, and notes regarding the building's compliance with by-laws.
- **Print Ready**: The final drawing will be ready for submission, presentation, or printing for further architectural or construction work.



a) ***Plan of Single Storeyed Residential Building as per Building by laws***

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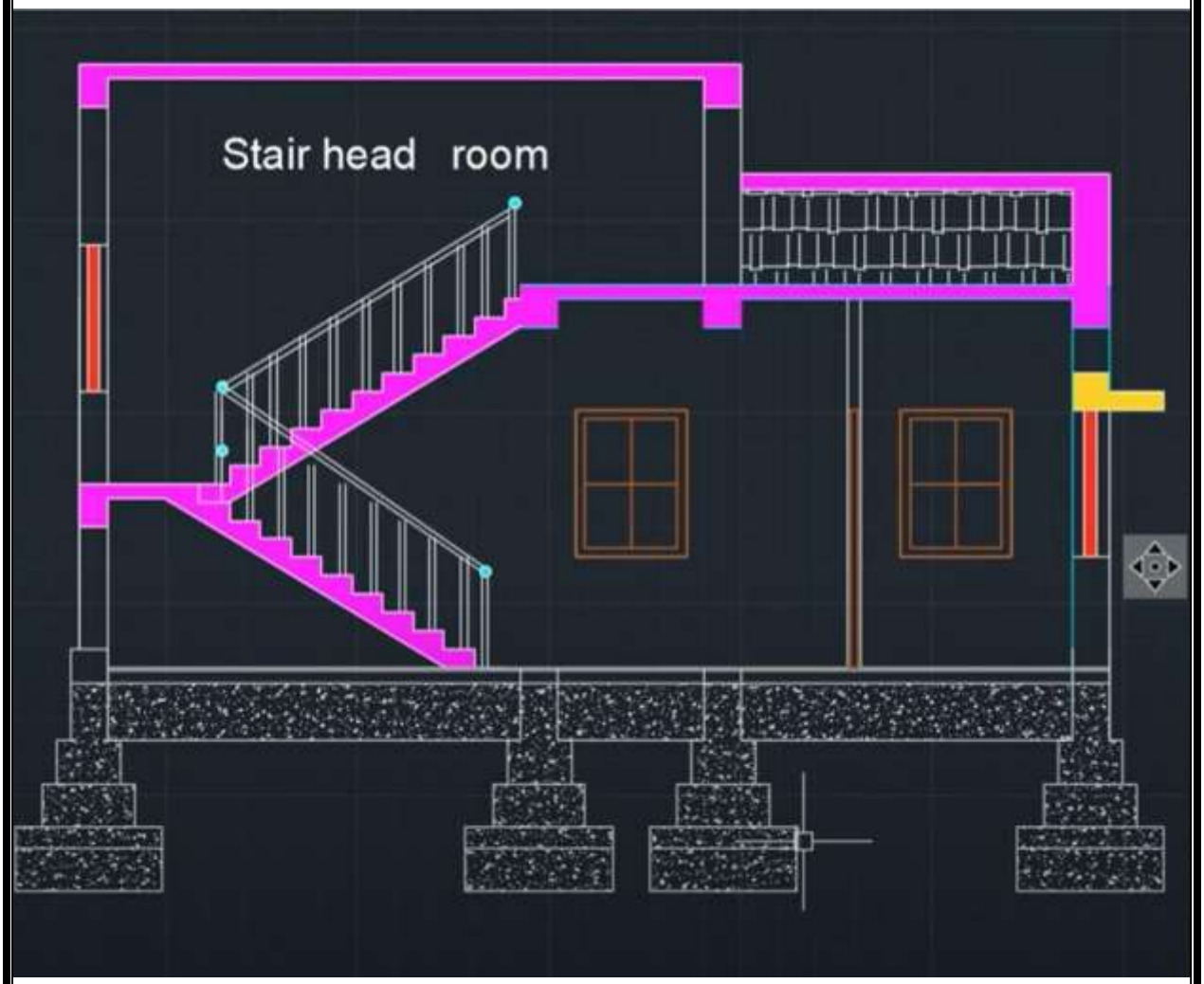


b) ***Sectional Elevation of Single storeyed Building as per Building by laws***

Experiment-7.

Developing a Public Building Plan in AutoCAD as per Building By- Laws

Aim

To create a detailed, accurate, and legally compliant architectural plan for a public building in AutoCAD, focusing on functional layout, adherence to building by-laws, and optimal utilization of space.

Software Used

Autodesk AutoCAD: Used for drafting 2D plans, creating precise layouts, and detailing all architectural components.

Step-by-Step Procedure in AutoCAD

- Preparation and Setup
- Understand the Project Requirements: Gather details on the purpose of the building, occupancy type, and building by-laws.
- Set Up AutoCAD Environment:
- Define units (meters or feet) using the UNITS command.
- Create layers for various components (e.g., walls, doors, windows, plumbing) for better organization.
- Site Plan Creation
- Use the LINE, PLINE, or RECTANGLE commands to draw the boundary of the site based on survey dimensions.
- Add setbacks as per by-laws using the OFFSET command.
- Mark surrounding roads, vegetation, and infrastructure.
- Floor Plan Drafting
    - ***Layout Design:***
- Draft the walls using the LINE or PLINE commands and ensure wall thickness aligns with structural requirements.
- Use the OFFSET command to create internal walls and partitions.
- Doors and Windows:

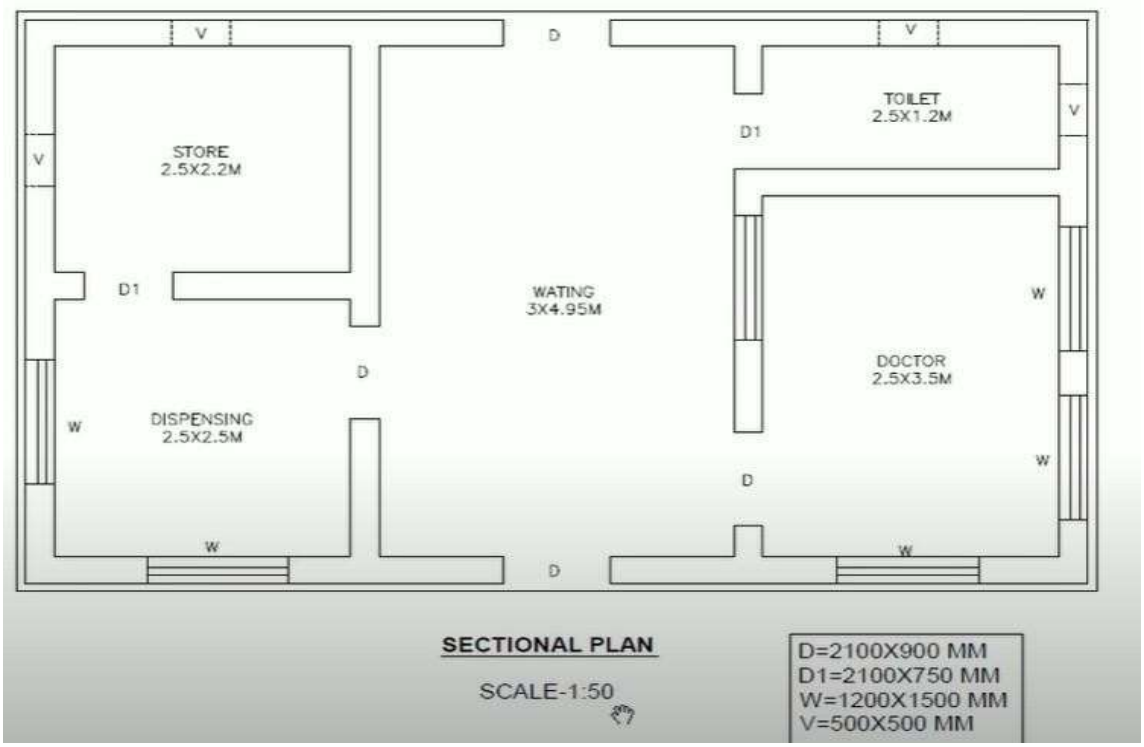
- Insert standard door and window blocks or draft them using RECTANGLE and ARC.
- Ensure they follow ventilation and accessibility standards as per by-laws.
    - ***Staircase and Lift:***
- Design staircases and lifts following the by-laws for dimensions and positioning.
    - ***Sanitation Facilities:***
- Allocate space for restrooms and ensure the layout complies with plumbing codes and accessibility standards.
- Structural Elements
- Add column and beam placements based on load calculations.
- Use the CIRCLE and LINE commands for column representation.
    - ***Annotation and Dimensioning***
- Add dimensions using the DIMLINEAR or DIMENSION commands to specify lengths, widths, and heights.
- Use the TEXT command to label rooms, services, and components.
- Include north direction using a custom north arrow or draw it manually.
- By-Law Compliance
    - ***Cross-check the plan with:***
- Setback requirements.
- Fire safety norms (e.g., emergency exits).
- Floor Area Ratio (FAR).
- Minimum room sizes.
- Accessibility provisions (ramps, lifts, etc.).
- Use hatch patterns (HATCH command) to highlight specific zones, such as fire exits or restricted areas.
- Finalizing the Plan
    - ***Add:***
- Legend: Define symbols used in the plan.
- Title Block: Include project title, scale, client details, and approval status.

- ***Scale: Adjust the drawing scale using SCALE to fit the final print size.***

- Review and Quality Check
- Perform a thorough check for errors or omissions.
- Ensure layers are properly used for clarity.
- Export and Printing
- Save the final file in .DWG format.
- Use the PLOT command to prepare the drawing for printing. Choose an appropriate scale and paper size.
- Export to .PDF if needed for sharing or approval.

- **Result**

- The completed project will include:
- A precise, layered 2D plan of the public building that meets all



Public Building Plan

Experiment -8

Developing section and elevation of public building.

Aim

To create detailed and accurate **section** and **elevation** views of a public building in **AutoCAD**, ensuring compliance with building by-laws and representing the building's structural and architectural elements clearly for construction and approval purposes.

Software Used

- **Autodesk AutoCAD**: Used to draft 2D sections and elevations with precision and clarity, adhering to by-laws.

Step-by-Step Procedure in AutoCAD

A. Developing Section

1. **Preparation**
    - **Understand the Layout**: Analyze the floor plan to decide where to cut the section, typically through key structural and functional areas like staircases, corridors, or entrances.
    - **Set Layers**: Create separate layers for walls, beams, floors, annotations, etc.
2. ***Drawing the Section Line***
    - On the floor plan, use the LINE or PLINE command to mark the section line.
    - Label the section (e.g., "Section A-A") using the TEXT command.
3. ***Drafting the Section View***
    - **Base Drawing**:
        - Project the section line details upward or downward.
        - Use the LINE and OFFSET commands to represent walls, slabs, floors, and beams.
    - ***Structural Elements***:
        - Add beams, columns, and slabs using the RECTANGLE,

LINE, and HATCH commands.

- ***Openings**:*
  - Show windows and doors as per their dimensions. Represent the frames and glass portions using the LINE, ARC, and HATCH commands.

- ***Floor Levels**:*
  - Indicate floor levels using dashed lines for ceiling and floor edges with the LAYER and LINETYPE commands.

4. ***By-Law Compliance for Sections***
   - Verify:
     - Ceiling height compliance.
     - Staircase rise and tread dimensions.
     - Headroom clearance as per fire safety and accessibility codes.
5. ***Annotation and Dimensioning***
   - Use the DIMLINEAR and DIMENSION commands for heights, floor thicknesses, and other critical dimensions.
   - Label key areas like staircases, ceilings, and rooms using TEXT.

B. ***Developing Elevation***

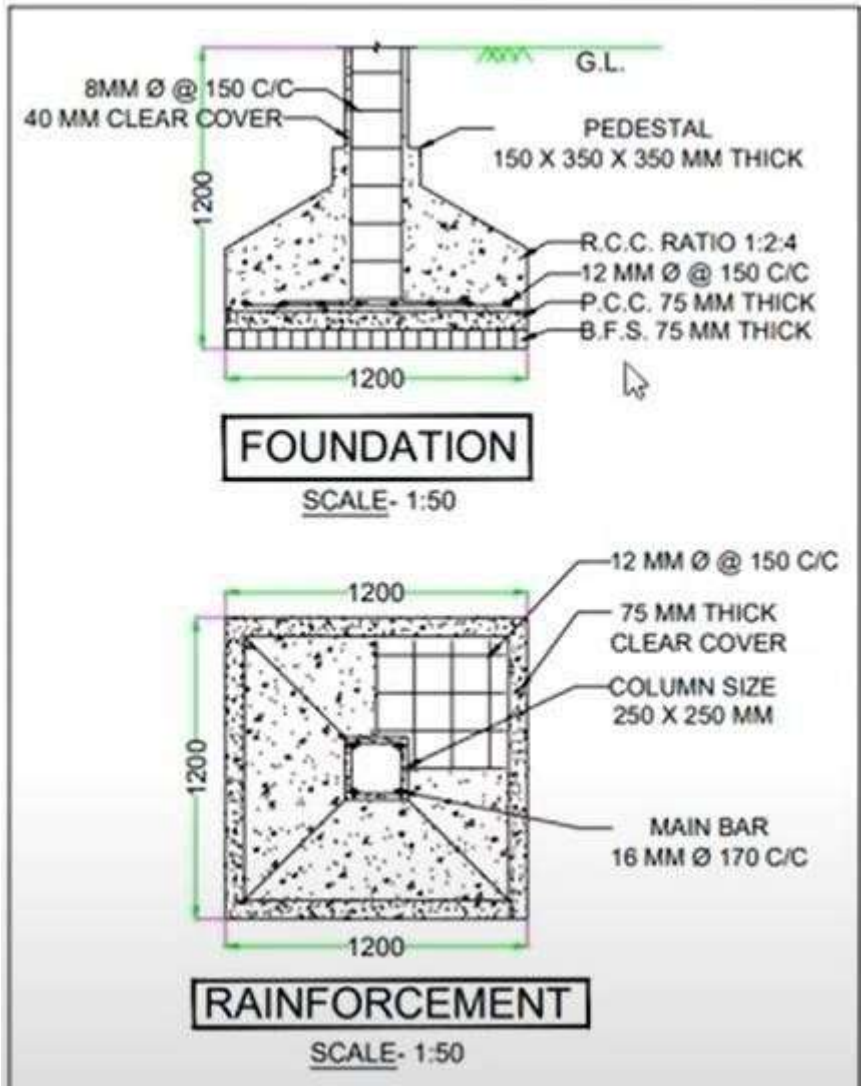
1. **Identify the Elevation**
    - Decide the view (front, rear, side) based on the design and by-laws.
    - Use the floor plan to project structural and architectural features.
2. ***Draft the Elevation***
    - **Base Drawing**:
        - Draw the building outline using the LINE and PLINE commands.
    - ***Facade Features****:*
        - Add windows, doors, and other facade details using blocks or the RECTANGLE and HATCH commands.
    - ***Roof Design****:*
        - Represent sloping roofs, parapet walls, or terraces with appropriate lines and arcs.
    - ***By-Law Compliance****:*
        - Ensure the building height does not exceed the permitted limit.
        - Include facade elements such as sunshades or projections within permissible limits
3. ***Finishing Details***
    - Add textures or materials using the HATCH command to represent walls, glass, or decorative elements.
    - Show ground level and plinth levels.
4. ***Annotation and Dimensioning***
    - Label floor levels, building height, and facade elements using the DIMLINEAR and TEXT commands.
    - Add a north arrow in the title block to show orientation.

Finalization

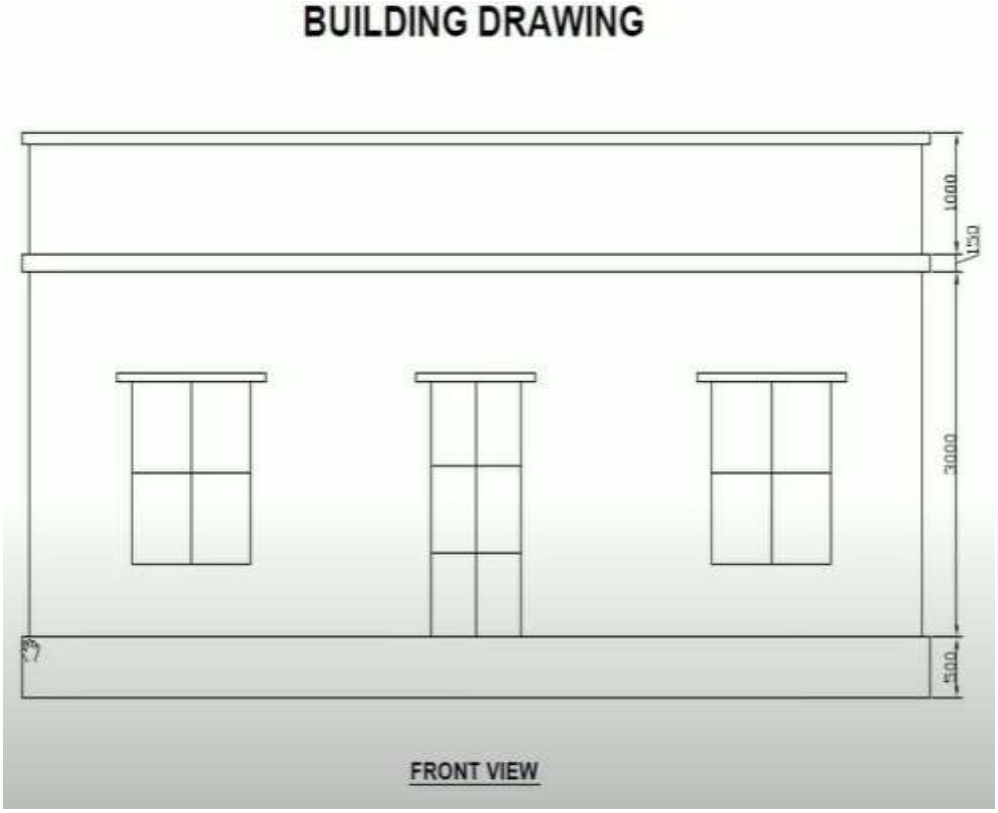
1. **Review and Quality Check**
    - Verify compliance with building by-laws:
        - Building height, projection limits, and facade elements.
        - Natural lighting and ventilation provisions.
    - Ensure layers and annotations are clear.
2. ***Export and Printing***
    - Use the PLOT command to set up printing. Adjust scale and paper size for clarity.
    - Export to .PDF for sharing or submission.

Result

- A **section view** that clearly shows internal elements such as walls, slabs, stairs, and structural features with proper annotations and dimensions.
- An **elevation view** that provides an aesthetically pleasing and accurate representation of the building facade.
- Both outputs are compliant with building by-laws and ready for submission to authorities or use in construction.



a) Section and Reinforcement Details of public building.



b) Elevation View of Public Building

Experiment-9

Development of working drawing of building –Electrical Layout.

Aim

The aim is to create an accurate, detailed, and functional **electrical layout** for a building, ensuring compliance with local building codes, safety regulations, and user requirements. The layout will include the placement of electrical systems such as wiring, lighting, switches, outlets, and distribution panels.

Software Used

- **Autodesk AutoCAD**: Used for drafting the 2D electrical layout of the building, integrating electrical components, and ensuring clear communication of electrical system designs.
- **Revit** (optional for BIM integration): For advanced building information modeling, especially for larger projects.

Step-by-Step Procedure

1. Preparation and Planning

- **Review the Architectural Plan**: Analyze the building's floor plan to understand the space requirements and the placement of rooms, doors, windows, and key fixtures.
- **Understand the Electrical Requirements**: Determine the electrical load, type of lighting, power needs, and safety considerations (e.g., emergency lighting, grounding).
- **Set Up Layers in AutoCAD**:
    - Create layers for different electrical components (e.g., lights, switches, power outlets, conduits) to maintain organization.
    - Ensure the drawing scale is appropriate for the project (e.g., 1:50, 1:100).

Marking Electrical Points

- **Power and Lighting Points**: Use AutoCAD's CIRCLE and BLOCK commands to represent electrical points such as light fixtures, power outlets, and switches.
    - Mark the exact locations of lighting fixtures, sockets, switches, and distribution boards as per the layout and electrical plan.
    - Use **symbols** for common components like switches (S), light fixtures (L), and outlets (O).
- **Lighting Fixtures**:
    - Place symbols representing ceiling lights, wall-mounted lights, or track lighting as per the design.
    - Ensure proper placement to meet lighting requirements (e.g., in corridors, rooms, and common areas).
- **Power Outlets**:
    - Place power outlets in strategic locations near walls or furniture.
    - Indicate whether the outlet is for general use or for specific appliances (e.g., HVAC systems, kitchen equipment).

2. Drawing Electrical Wiring

- **Electrical Circuits and Wiring**:
    - Use AutoCAD's LINE or PLINE commands to draw wiring paths between electrical points (outlets, switches, light fixtures).
    - Indicate power and lighting circuits, ensuring that each circuit is connected to the correct breaker and distribution panel.
    - Show the location of junction boxes and conduits using BLOCK symbols or detailed shapes to ensure clarity in the wiring setup.
- **Conduit and Cable Routing**:
    - Draw the conduit paths for both power and lighting cables, ensuring they comply with the building's structural features.
    - Use specific line types for high voltage (HV) and low voltage (LV) wiring, if needed, using the LTYPE command.

3. Switches and Paneling

- **Switch Placement**:
    - Indicate the location of switches and their types (single-pole, three-way, dimmer).
    - Ensure switches are easily accessible and follow by-law requirements for height and location.
- **Distribution Panel**:
    - Mark the location of the electrical distribution panel, ensuring compliance with local codes regarding placement (e.g., not in bathrooms or near water).
    - Draw the connections to major electrical systems like lighting and power circuits.

4. Integration with Other Systems

- **HVAC Systems**:
    - Indicate connections to HVAC systems (air conditioning, heating) and ensure dedicated circuits where necessary.
- **Fire and Safety Systems**:
    - Ensure that electrical systems related to emergency lighting, fire alarms, and security systems are integrated and marked on the layout.

5. Load Calculation and Circuit Design

- **Load Calculation**:
    - Ensure that each electrical circuit is correctly sized based on the anticipated load.

- Calculate the required breaker ratings and wire sizes for each circuit.

- **Circuit Design**:
  - Label each circuit with its intended purpose (e.g., lighting, outlets, HVAC).
  - Use AutoCAD's annotation tools (TEXT or MTEXT) to label circuits and components clearly.

6. Annotation and Dimensioning

- **Dimensioning**:
  - Use the DIMLINEAR or DIM commands to show distances between outlets, switches, and light fixtures.
  - Label dimensions of electrical panels and cable pathways.
- **Labeling**:
  - Use TEXT to label each component and circuit, ensuring the electrical layout is clear and easy to follow.
  - Provide details like the power rating of outlets, the type of lights used, and the type of switch.

7. Finalizing and Reviewing

- **Review the Layout**:
  - Double-check the layout for compliance with building codes, especially regarding the placement of outlets, switches, and circuits.
  - Verify that the design supports the intended use of the space and follows the required safety standards.
- **Add Title Block and Legends**:
  - Create a **title block** with project details, including client name, project number, date, scale, and a drawing legend that defines the symbols used.
  - Include the electrical panel's power rating and any notes related to

the electrical system.

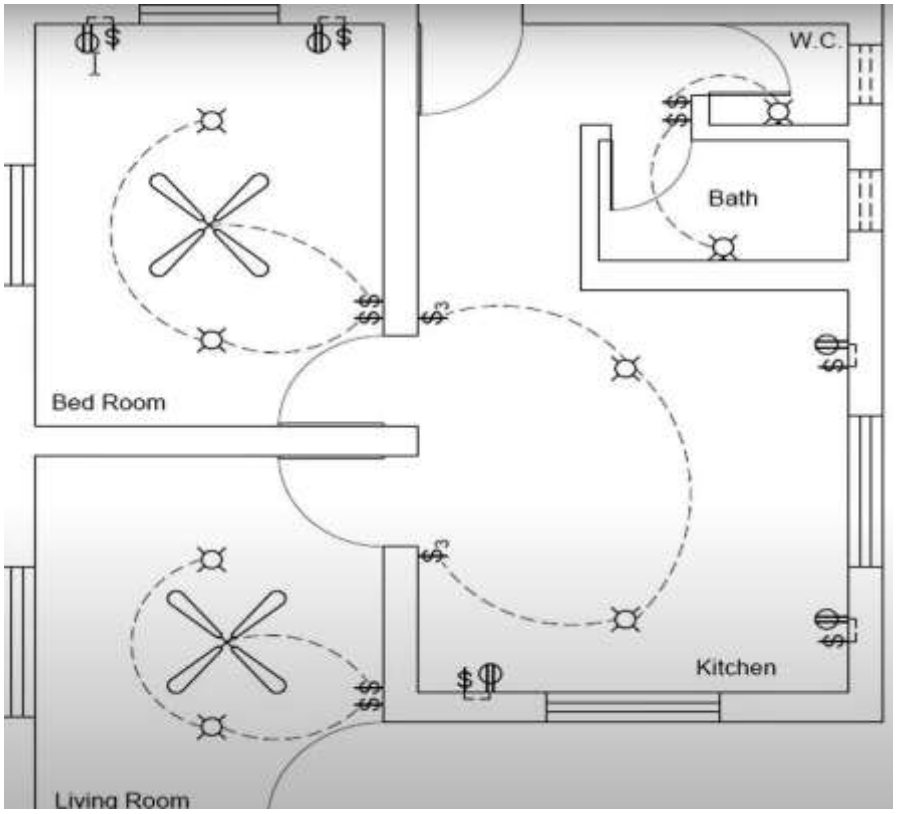
8. Exporting and Printing

- **Plot the Drawing**:
  - Use the PLOT command to set up the layout for printing.
  - Ensure that the scale is appropriate and that the drawing is clear and legible.
- **Save the File**:
  - Save the AutoCAD file in .DWG format for future reference or sharing.
  - Export a PDF version of the layout for submission or review.

Result

- **Detailed Electrical Layout**: A fully developed working drawing that clearly represents the electrical system for the building, including wiring, lighting, power outlets, and switches.
- **Compliance with Building Codes**: The electrical layout adheres to local building by-laws, safety standards, and project-specific requirements.
- **Clear Communication**: The layout is well-documented with annotations, dimensions, and labels, ensuring that electrical engineers and construction teams can easily interpret the design.
- **Submission-Ready Drawing**: The final drawing is ready for submission to authorities, electrical engineers, or contractors for review and implementation.

This process ensures that the building's electrical system is safe, efficient, and in compliance with regulations.



Working drawing of building –Electrical Layout.

Experiment-10

Development of working drawing of building – Plumbing Layout

Aim

The aim is to develop a comprehensive and accurate **plumbing layout** for a building, ensuring it meets all local plumbing codes and by-laws. The layout will include the placement of water supply systems, drainage systems, and other related plumbing fixtures, ensuring optimal functionality and compliance with safety and accessibility standards.

Software Used

- **Autodesk AutoCAD**: Primary software for drafting the plumbing layout, including water supply lines, drainages, vents, and plumbing fixtures in a clear, dimensioned 2D format.
- **Revit (optional)**: For larger projects requiring Building Information Modeling (BIM), where plumbing elements are integrated with other building systems.

Step-by-Step Procedure

1. Preparation and Planning

- **Review Architectural Plans**: Analyze the floor plan of the building to understand the location of key plumbing components such as bathrooms, kitchens, utility rooms, and water supply points.
- ***Understand Plumbing Requirements***:
    - Water supply requirements (pressure, capacity, and source).
    - Drainage systems and venting for waste disposal.
    - Appliances like water heaters, dishwashers, and washing machines.
    - Local plumbing codes and by-laws, which govern pipe sizing, slope, and venting.

- ***Set Up Layers in AutoCAD**:*
    - Create different layers for water supply, drainage, venting, and annotations for clarity. Common layers could include:
        - **Water supply lines**
        - **Wastewater lines**
        - **Venting lines**
        - **Fixtures and appliances**
- ***Drainage Connection**:*
    - Indicate the connection to the municipal sewage line or septic tank, depending on the project.
    - Add clean-out points where necessary for easy maintenance and use appropriate symbols (CIRCLE or custom blocks).

2. *Fixtures and Appliances Placement*

- **Toilets, Sinks, Showers**:
    - Position plumbing fixtures (toilets, sinks, showers, bathtubs) on the floor plan.
    - Use appropriate plumbing symbols for each fixture.
    - Ensure that the layout meets building by-laws regarding fixture placement, minimum space requirements, and accessibility for people with disabilities.
- ***Water Heater**:*
    - Identify the placement of the water heater and ensure it is located near the main water line for efficient operation.
    - Include connections for both hot and cold water lines.
- ***Dishwashers/Washing Machines**:*
    - Include connections for appliances that require water, such as dishwashers and washing machines.
    - Draw water inlet and drainage lines to these appliances.

3. ***Annotation and Dimensioning***

- **Dimensioning**:
  - Use the DIMLINEAR or DIM commands to add dimensions to all pipes, fixtures, and equipment locations.
  - Label pipe sizes, slope directions, and fixture locations using the TEXT tool for clarity.
- ***Label Fixtures****:*
  - Label each fixture (e.g., sink, toilet) and its connection to the water supply or drainage system using text annotations.
- ***Material Specifications****:*

4. Water Supply System Layout

- **Source of Water**: Identify the water source (e.g., municipal supply, well) and draw the main water line from the source into the building.
- ***Main Water Line****:*
  - Use the LINE or PLINE commands to draw the main water supply pipe leading to the building, ensuring it follows the shortest and most practical route.
  - Indicate the size of the pipe and material used (e.g., PVC, copper) using text annotations (TEXT or MTEXT).
- ***Branch Lines****:*
  - From the main supply line, draw branch pipes to various fixtures (bathrooms, kitchens, utility rooms).
  - Ensure proper sizing of branch lines based on the flow requirement of each fixture.
  - Use the LINE or PLINE commands to represent the branches and provide dimensions to ensure correct pipe sizing.
- ***Water Fixtures****:*
  - Place symbols for water fixtures such as sinks, toilets, bathtubs, and showers using blocks or the CIRCLE, RECTANGLE, and BLOCK commands.
  - Label each fixture clearly with TEXT or MTEXT for clarity.

5. ***Drainage System Layout***

- **Drainage Pipes**:
  - Draw the drain lines starting from the fixtures (toilets, sinks, bathtubs) using the LINE or PLINE commands.
  - Ensure that the drain lines slope correctly (typically 1/4 inch per foot or as required by local codes) to allow for gravity-driven waste removal.
  - Indicate the pipe size and material (e.g., PVC, cast iron) using annotations.
- ***Vent Pipes****:*
  - Draw the vent pipes connected to each fixture's drain line, which prevent airlocks and allow wastewater to flow freely.
  - Vent lines typically run vertically and should be drawn with clear connections to the main vent stack.
  - Use symbols like CIRCLE to represent the vent pipe connections.
  - Annotate the material type for each pipe (e.g., copper for water supply, PVC for drainage) and pipe diameter using the TEXT tool.

6. ***Reviewing and Quality Control***

- **Check for Compliance**:
  - Ensure that the plumbing layout complies with local plumbing codes, including:
    - Pipe sizing for water supply and drainage.
    - Proper slope for drain lines.
    - Minimum fixture space and accessibility.
    - Proper venting of drain lines.
- ***Verify Connections****:*
  - Double-check that all plumbing fixtures are correctly connected to

water supply and drainage lines.

- Ensure that there are no errors in pipe routing or sizing.

7. ***Finalizing the Drawing***

- **Legend and Title Block**:
  - Create a **legend** to explain the symbols used for fixtures, pipes, and connections.
  - Add a **title block** with project information such as the building name, project number, date, and scale.
- ***Final Review****:*
  - Ensure the drawing is clear, with appropriate layers and annotations.
  - Conduct a final quality check to verify that all plumbing fixtures, pipes, and equipment are represented correctly.

8. ***Export and Printing***

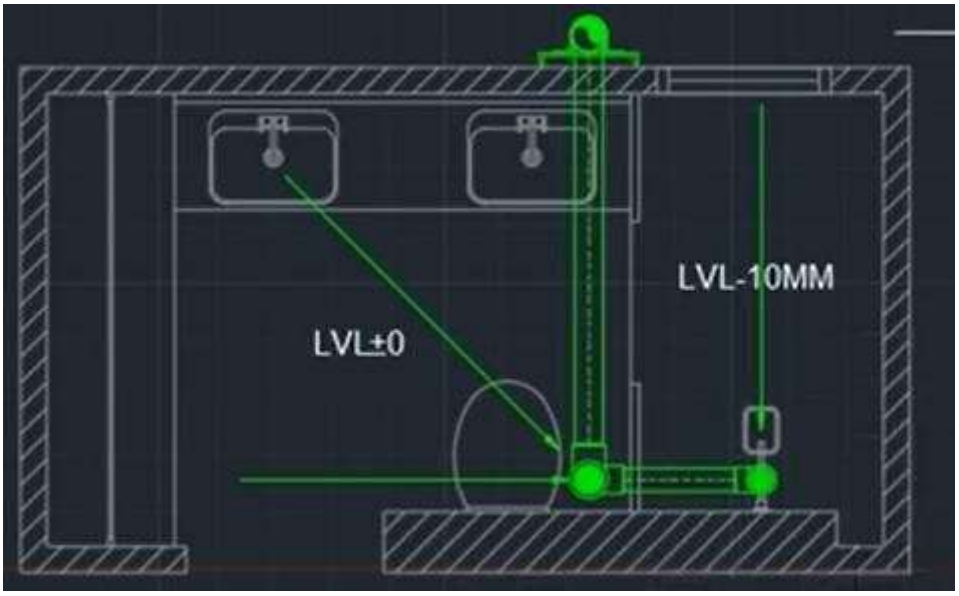
- **Plot the Drawing**:
  - Use the PLOT command to prepare the drawing for printing.
  - Ensure the correct scale is used for the print size.
- ***Save and Export****:*
  - Save the drawing in .DWG format for future reference or sharing.
  - Export the drawing to .PDF if required for submission or review.

Result

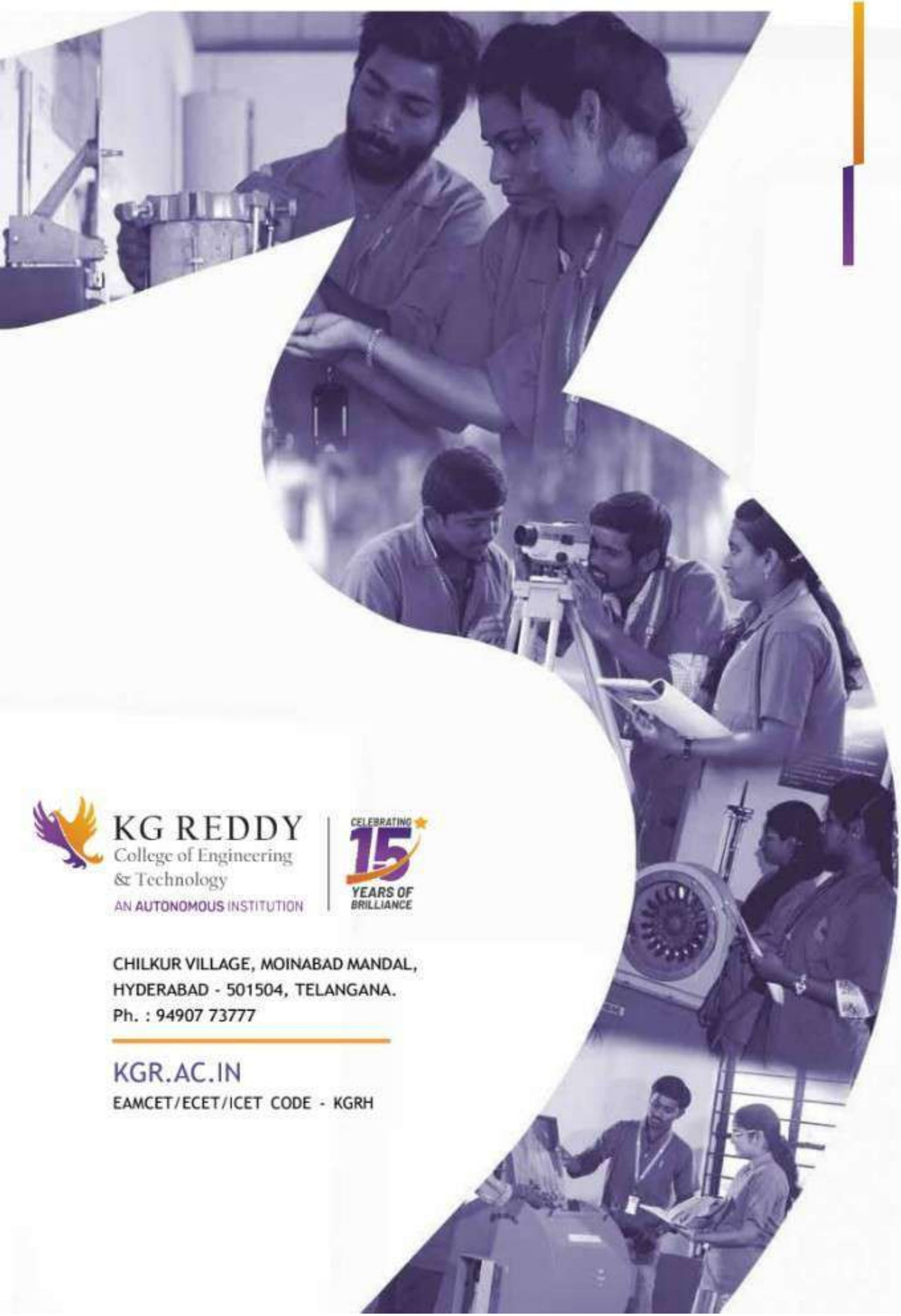
- **Plumbing Layout Drawing**: A detailed and accurate plumbing layout drawing for the building, clearly showing all water supply, drainage, and vent systems, including fixtures, pipes, and connections.

- **Compliance with Codes**: The layout adheres to local plumbing codes and regulations regarding pipe sizes, fixture placement, and accessibility.
- **Clear Communication**: The drawing includes appropriate annotations, dimensions, and legends for easy interpretation by plumbers, contractors, and other stakeholders.
- **Ready for Implementation**: The plumbing layout is complete, reviewed, and ready for submission to authorities, contractors, or engineers for approval and construction.

This process ensures the building's plumbing system is efficient, safe, and meets all necessary standards for functionality and compliance.



Plan of Simple Plumbing System Layout



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