

ATME COLLEGE OF ENGINEERING

13th KM Stone, Bannur Road, Mysuru - 560 028



A T M E
College of Engineering

DEPARTMENT OF CIVIL ENGINEERING



LABORATORY MANUAL

(ACADEMIC YEAR 2026-27)

SUBJECT: BUILDING CAD AND 3D MODELLING LAB

SUBJECT CODE: 1BCVL306

SEMESTER: III



A T M E
College of Engineering



DEPARTMENT OF CIVIL ENGINEERING

Course: BUILDING CAD AND 3D MODELLING LAB

Course code: 1BCVL306

Prepared by

Faculty	Name
1	Prof. Likhith M L

INSTITUTIONAL VISION AND MISSION

Vision:

Development of academically excellent, culturally vibrant, socially responsible and globally competent human resources.

Mission:

- To keep pace with advancements in knowledge and make the students competitive and capable at the global level.
- To create an environment for the students to acquire the right physical, intellectual, emotional and moral foundations and shine as torch bearers of tomorrow's society.
- To strive to attain ever-higher benchmarks of educational excellence.

DEPARTMENT VISION AND MISSION

Vision:

To develop globally competent civil engineers who excel in academics, research and are ethically responsible for the development of the society.

Mission of the Department

- To provide quality education through faculty and state of art infrastructure.
- To identify the current problems in society pertaining to Civil Engineering disciplines and to address them effectively and efficiently.
- To inculcate the habit of research and entrepreneurship in our graduates to address current infrastructure needs of society.

Program Educational Objectives (PEOs)

PEO 1 - Engaged in professional practices, such as construction, environmental, geotechnical, structural, transportation, water resource engineering by using technical, communication and management skills.

PEO 2 - Engaged in higher studies and research activities in various civil engineering fields and life time commitment to learn ever changing technologies to satisfy increasing demand of sustainable infrastructural facilities.

PEO 3 - Serve in a leadership position in any professional or community organization or local or state engineering board

PEO 4 - Registered as professional engineer or developed a strong ability leading to professional licensure being an entrepreneur.

Program Specific Outcomes (PSOs)

PSO 1 – Provide necessary solutions to build infrastructure for all situations through competitive plans, maps and designs with the aid of a thorough Engineering Survey and Quantity Estimation.

PSO 2 – Assess the impact of anthropogenic activities leading to environmental imbalance on land, in water & in air and provide necessary viable solutions revamping water resources and transportation for a sustainable development

Program Outcomes (POs)

Engineering Graduates will be able to:

PO1. Engineering Knowledge: Apply fundamental knowledge to solve complex engineering problems.

PO2. Problem Analysis: Identify and formulate complex problems to reach substantiated conclusions.

PO3. Design/Development of Solutions: Create solutions that meet specific needs, considering health, safety, and environmental factors.

PO4. Conduct Investigations of Complex Problems: Use research-based methods to design experiments, analyze, and interpret data.

PO5. Engineering Tool Usage: Select and apply modern techniques and IT tools to engineering activities.

PO6. The Engineer and the World: Understand the impact of professional engineering solutions on society and the environment.

PO7. Ethics: Commit to professional ethics and responsibilities.

PO8. Individual and Collaborative Teamwork: Function effectively as an individual or team member in multidisciplinary settings.

PO9. Communication: Communicate effectively regarding complex engineering activities with the engineering community and society.

PO10. Project Management and Finance: Apply management and financial principles to project work.

PO11. Life-Long Learning: Engage in independent and life-long learning in the context of technological change.

PREFACE

The *Manual on BUILDING CAD AND 3D MODELLING LAB* has been prepared to provide engineering students with a clear understanding of the principles, practices, and methodologies involved in assembling, configuring, and planning computer systems.

With rapid advancements in technology, engineers are expected not only to possess theoretical knowledge but also to demonstrate hands-on proficiency in handling computer hardware and system design. This manual bridges that gap by offering a step-by-step approach—from identifying hardware components to integrating them into a fully functional system, while also considering factors such as performance, cost, and sustainability.

The manual is structured to support both classroom instruction and laboratory sessions, encouraging students to apply analytical thinking and practical skills in real-world scenarios. It aims to strengthen their foundation in computer system architecture, promote systematic planning, and enhance their technical competency in modern computing environments.

It is hoped that this manual will serve as a valuable resource for students, guiding them towards a deeper understanding of computer systems and preparing them for future challenges in the field of engineering and technology.

BUILDING CAD AND 3D MODELLING LAB		Semester	3
Course Code	1BCVL306	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	30 (0:0:28:2)	SEE Marks	50
Credits	01	Exam Hours	100
Examination type (SEE)	practical		
Course outcome (Course Skill Set)			
At the end of the course, the student will be able to:			
1. CO1: Describe CAD interface, units, layers, snaps, and aids for building drafting. (L2)			
2. CO2: Create detailed 2D plans, elevations, sections of institutional buildings using layers, hatches, dimensions. (L3)			
3. CO3: Develop 3D models of buildings, generate multi-views, and apply basic rendering. (L3)			
4. CO4: Organize complex drawings with blocks, XREFs, layouts for collaboration and standards compliance. (L4)			
5. CO5: Export models for estimation, BIM intro, presentations; reflect on civil applications. (L3)			
Experiments			
PART – A			
FIXED SET OF EXPERIMENTS			
Students shall perform practical exercises related to:			
1. CAD basics: Interface setup, units (metric), limits, layers (walls, doors, dimensions), OSNAPs, modify commands; draw simple room shapes, annotate.			
2. Residential plan: Detailed plan with rooms, doors/windows (standard sizes: doors 900x2100mm, windows 1200x1200mm), furniture blocks, dimensions 1:100 scale.			
3. Residential elevation/section: Matching elevation, cross-section with hatching (walls 230mm brick, slab 150mm), stairs, roof.			
4. School building plan: Ground +1 floor plan (classrooms 7x8m, staff room, hall 20x10m, toilets, corridors), doors/windows, ramps for accessibility, grid lines, 1:100 scale.			
5. School elevation/sections: Front/side elevations, longitudinal section showing plinth (750mm), parapet, solar panels; hatches for materials.			
6. Office building plan: G+2 commercial office (reception, cabins 4x4m, open workstations, conference 10x6m, parking layout), lifts, services ducts, 1:100.			
7. Office elevations/sections: Multi-level elevations, sections with column grids (6x6m bay), beam details, glazing.			
8. Primary health center (PHC) plan: OPD rooms, waiting area, lab, pharmacy, wards (4 beds), admin, generator backup, circulation for patients, 1:100 scale.			
9. PHC elevations/sections: Elevations with ramps (1:12), sections showing ventilation, septic tank stub, green features.			

PART – B

OPEN ENDED EXPERIMENTS

Open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning. Students may be assigned any one of the open-ended problem statements during assessment. The sample open-ended problems are provided as reference. Course coordinators are encouraged to design and assign context-specific open-ended problem statements aligned with the defined Course Outcomes (COs), ensuring relevance to contemporary practices and learner needs.

1. Complete working drawings (plan, 2 elevations, 2 sections) for school/office/PHC variant; advanced layers, dynamic blocks, title block with BOM.
2. 3D modeling: Extrude school/office/PHC plans to full model (floors, roof, doors/windows), UCS views, section planes, basic materials/rendering (Revit/AutoCAD 3D).
3. Collaborative set: XREF plans/elevations/3D from peers, assemble layout sheets, plot PDFs; BIM export intro (IFC format).
4. Quantity takeoff: Area/volume from 3D model (floors, walls), Excel link; sustainability check (green area >20%)

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE marks awarded shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. Total marks for the all report shall be scaled down to 30 marks. The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and Marks scored shall be scaled down to 20 marks. Final average of marks for report and test shall be out of 50 marks. For both CIE and SEE, the student is required to conduct one experiment each from both Part A and Part B.

Eligibility for SEE:

- To qualify and become eligible to appear for SEE, in the **CIE component**, a student must secure a **minimum of 40% of 50 marks, i.e., 20 marks.**
- To pass the **SEE component**, a student must secure a **minimum of 35% of 50 marks, i.e., 18 marks.**
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks.**

Note:

1. The laboratory syllabus consists of PART-A and PART-B. While PART-A has 6 conventional experiments, PART-B has 6 typical open-ended experiments. The maximum marks for the laboratory course are 100.
2. Both PART-A and PART-B are considered for CIE and SEE.
3. Students have answer 1(one) question from PART-A and 1(one) question from PART-B.
 - a. The questions set for SEE shall be from among the experiments under PART-A. It is evaluated for **70 marks** out of the maximum 100 marks.
 - b. The open-ended question set for SEE shall be any other open-ended question and not selected from the experiments under PART-A. It shall be evaluated for **30 marks.**
4. For Continuous Internal Evaluation (CIE) during the semester, classwork shall typically include open ended. questions from **Part-B**, along with other similar questions designed to enhance the students' skills.

Suggested Learning Resources:**Text books:**

1. MG Shah, CM Kale, SY Patki, “Building Drawing with an Integrated Approach to Built Environment Drawing”, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. S.S. Bhavikatti and M.V. Chitawadagi, “Building Planning and Drawing”, I K International Publishing House Pvt. Ltd., New Delhi.
3. Gurucharan Singh, “Building Construction”, Standard Publishers & Distributors, New Delhi.
4. RS Malik and GS Meo, “Civil Engineering Drawing”, Asian Publishers / Computech Publications Pvt. Ltd., New Delhi.
5. Sham Tickoo. AutoCAD 2024 for Engineers and Designers (or latest edition) – 2D drafting and 3D modelling with civil/architectural examples.
6. Munir Hamad. AutoCAD for Architectural Drawing and Design – building plans, elevations and basic 3D for buildings.
7. Elise Moss. Introducing AutoCAD Civil 3D – site, road and basic infrastructure modelling using Civil 3D.

Reference books / Manuals:

1. Dodge F.W., “*Time Saver Standards for Building Types*”, F.W. Dodge Corp., New York.
2. IS: 962 – 1989 – “*Code of Practice for Architectural and Building Drawing*”, BIS, New Delhi.
3. “*National Building Code of India*”, BIS, New Delhi.
4. Prof. Anil A. Patil. Computer Aided Building Drawing
5. Louisa Jahn, Dustin Manning. Mastering Autodesk Civil 3D – advanced corridor, grading and infrastructure workflows.

Web links and Video Lectures (e-Resources):

1. NPTEL: Computer Aided Design – Introductory CAD concepts and 3D modelling (lecture series by IIT Delhi / IITs).
2. NPTEL / IIT Hyderabad: Computer Aided Engineering Drawing and Design – 2D/3D CAD, drafting standards, projections useful before AutoCAD practice.
3. NPTEL / BIM-related courses: Building Information Modeling (BIM) – conceptual and workflow understanding for 3D model-based building/infrastructure projects (IITM Pravartak / similar).

TITLE: DRAWING BASICS

LEARNING OBJECTIVES:

- To concentrate on basics of AutoCAD, which is the base for drafting.
- To use the functions and commands of AutoCAD software to create, save, and print drawings that make use of multiple lines, geometric shapes, and curves.
- To locate and apply the many features of AutoCAD that automates the drafting process and facilitate the creation of more accurate drawings in less time than traditional drafting methods.
- To locate and apply the features of AutoCAD that provide for the accurate addition of dimensions, tolerances, and drawing notes and labels using symbols and placements recognized by multiple standards organizations.
- To use the functions and commands of AutoCAD software to create isometric and three dimensional drawings and models.

AIM:

- To study the basics of AutoCAD.

MATERIAL / EQUIPMENT REQUIRED:

- Computer with AutoCAD

THEORY / HYPOTHESIS:

- **AutoCAD (Automated Computer Aided Drafting)** is the most widely used computer aided drawing / drafting package. AutoCAD is a 2 D and 3 D computer aided drafting software application used in architecture, construction and manufacturing to assist in the preparation of blueprints and other engineering plans. AutoCAD provides a common look and feel GUI facilities to the learner to make great use of windows environment. AutoCAD is simple to learn, use and draw which provides multiple document opening facility so the user can exchange data between different files and to compare files more easily.

PROCEDURE / PROGRAMME / ACTIVITY:

- Start an AutoCAD session by double clicking on an AutoCAD icon.
- AutoCAD opens, loads the menu and AutoCAD editor screen which contains the drawing area, command line, standard tool bar, status bar, etc.
- Some of the basic commands used in AutoCAD are as follows.

DRAWING TOOLS

LINE

- Line command is used to draw straight line segment.
- Command: LINE or L
- Tool Bar: Draw line

- **CO ORDINATE SYSTEMS**

- **Absolute co ordinate system**

- In this system, location of a point is described with reference of a previous point and hence is called relative co ordinate system.

- **Relative co ordinate system**

- In this system, location of a point is described with reference of a previous point and hence is called relative co ordinate system.

Polar co ordinate system

- In this system, the location of a point is described in terms of the length of a line and direction with reference to a previous point.

POLY LINE

- Command: PO
- Tool bar: Draw Poly line

CIRCLE

- Circle command is used to draw a circle.
- Command: Circle
- Tool bar: Draw circle

Types can be drawn by using following methods.

- Center point:
- Specify the radius of circle or diameter, specify or point (P), enter a radius or enter a diameter by d
- Radius:
- Specify the centre of the circle and give the value of radius.
- Specify the value of diameter after d
- Diameter:
- Specify the center of circle and to give diameter press d . Specify the value of diameter of given circle.
- 3P (3 points):
- This method allows user to pick any three points randomly, then AutoCAD draws a circle touching all the three points.
- Specify the first point of the circle P1
- Specify the second point of the circle P2
- Specify the third point of the circle P3
- TTR (Tangent Tangent_Radius) allows the user to pick two tangent points and a radius.

- Specify the first tangent of given point(T1)
- Specify the second tangent of given object(T2)
- Specify the radius of circle
- TTT (tangent tangent tangent)
- Specify the first tangent (T1) second tangent(T2) and third tangent (T3) to draw the circle.

ARC

- Arc command is used to draw an arc. An arc is a portion of a circle. Therefore it is necessary to specify the centre, radius, start and end point of the arc.
- Command: NARC or a
- Tool bar: draw an arc.

Types of arc

- Three point:
Arc passes through given three points. Pick start, second and end point.
- Start and direction:
Pick start point, pick end point and pick direction through straight point.
- Start center end:
Pick start point, pick center and pick end of an arc.
- Start end radius:
Pick start point; pick end and type radius of arc or show radius on arc.
- Start center angle:
Pick start point, pick center and end point.
- Center start end:
Pick center, pick start point and end point.
- Start center length of chord
Pick start, pick center and enter length of chord
- Center start angle
Pick center, start point, center angle (counter clockwise from start point)
- Start end angle
Pick start point, pick end point, specify angle.

DONUT

- The DONUT command can be used to create a solid filled Circle as well as the standard object that the DONUT command is normally used for. The DONUT command normally is used to draw a circle with a thick outer edge and open in the middle, hence the command name DONUT. By changing the inside diameter to 0 (zero) you can make it create a solid filled circle.
- Command: DONUT or do
- Tool bar: Draw DONUT.
- Enter inside diameter of DONUT.
- Enter outside diameter of DONUT.
- Specify the centre of the DONUT.

ELLIPSE

- Command: ELLIPSE or El
- Tool bar: Draw ellipse
- Pick the centre point option of ellipse.
- Pick axis and point.
- Specify the distance to the other axis or rotation, pick a point P or specify a distance using key board and press .

POLYGON

- Polygons are multi sided closed figure with equal side lengths.
- Command: POLYGON or POLY
- Tool bar: Draw polygon.
- Inscribed or circumscribed polygons are available in AutoCAD.
- Specify the number of sides.
- Specify the centre of polygon or edges.
- Enter the option pick I or C from command bar.
- Pick the value of the radius and specify the radius.

MODIFYING TOOLS

ERASE

- Removes objects from a drawing.
- Command: E or Erase
- Tool bar: Erase and select the object to be erased.

MOVE

- Move helps to displace the objects to the specified distance in specified direction.
Command: Move or M
- Tool bar: Move
- Select the required object and then and by selecting the base point, displace the selected object by scrolling the mouse and place it.

COPY

- Copy helps to duplicate or create a copy of a particular object.
- Command: CO or copy
- Tool bar: Copy
- Specified object is selected and then press and select the base point and press . If multiple copies are required and copied objects are placed in the destiny.

MIRROR

- Many drawings have identical elements, say for an example, twin house drawings or any mechanical drawings; you create one half or one quarter of a drawing and complete it simply mirroring what you have drawn already.
- Command: MI or mirror
- Tool bar: Mirror
- Select the object and press , then specify the first point of the mirror line and the second point and press Y if the copy is to be displayed and N for mirrored image.

OFFSET

- The offset command is used to create any entity parallel to one existing object.
- Command: O or offset
- Tool bar: Offset
- Select the object to offset, specify the distance or T to press the distance required for the user to place the object.

ARRAY

- It creates multiple copies of an object in a pattern.
- Command: Array
- Tool bar: Array
- Array menu bar will appear and select the type of array required.

POLAR ARRAY

- It creates an array defined by specifying a centre point or base point of the object which it replicates the selected object.

RECTANGULAR ARRAY

- It creates an array defined by a number of rows or columns of copies of the selected object.

ROTATE

- It is used to rotate the selected group of objects about specified base point through a given angle.
- Command: Rotate or RO
- Tool bar: Rotate
- Select object to rotate and press . Specify the base point, pick a base point (point about which object rotates). Specify rotation angle (reference) or simply specify an angle.

REFERENCE

- The option is used to align object to another by specifying angle.

SCALE

- Enlarges or reduces the selected objects equally in x, y and z directions.
- Command: SC or scale
- Tool bar: Scale
- Select the object which are to be scaled. Specify the base point on object, specify the scale factor and then enter the value for scaling.

SCALE FACTOR

- Multiplies the dimensions of the selected objects by the specified scale. A scale factor is greater than 1, enlarges the object and scale between 0 and 1, and shrinks the object.

STRETCH

- Moves or stretches the object.
- Command: Stretch or S
- Tool bar: Stretch
- Selecting the object by making crossing window and press specify the base point or pick a

point to enlarge the shape and line of the object by pulling or pushing from

one side and also to move object from one place to another place.

TRIM

- Trim command is used to trim objects. To trim an object, you must specify the cutting edge, which defines the point at which the AutoCAD cuts the object you want to trim.
- Command: Trim or TR
- Tool bar: Trim
- By giving the trim command and press and select the object which should be discovered from the drawing.

EXTEND

- Extend is used for extension of a line or an arc to the destiny point.
- Command: Ex
- Tool bar: Extender

BREAKING OBJECTS

- The break command is used to break the object at the point or points you specify. To break line, choose break from modify tool bar and follow the prompts.
- Command: Break
- Select object: pick object to break.

CHAMFER

- The CHAMFER command creates corners from two non parallel lines. It allows the user to chamfer poly line, rays etc.
- Command: Chamfer

FILLET

The fillet command creates rounded corners replacing two lines with arc. It allows the user to chamfer poly lines, rays etc.

- Command: Fillet

DIVIDE

- This divides selected objects into specified number of equal distance by intersecting marker point on the object.
- Command: divide or div

- Explode
- Entities like rectangular

MEASURE

- Starts at one end of the object measure out segments of specified length between each point or block.
- Command: Measure
- Tool bar: Draw point measure
- Select object to measure: Pick an object
- Specify length of the segment: enter length of segment

EXPLODE

- Entities like rectangle, polygon and poly lines are considered as one entity even though they are made up of segments. To connect them into individual segment, explode command is used.
- Command: X
- Tool bar: Explode
- Select object to explode and press

CREATING TEXT OBJECT

- The text information is essential to understand any drawing. Text is used for title box, labeling of parts, to give specification or to make notations in the drawing. Broadly there are two types of text items used in AutoCAD.
- Single line text
- Double line text
- Command: Text
- Tool bar: Single line text
- A text style dialogue box will appear as follows.
- Select font name, font style and height of text.
- Also enter width factor and oblique angle. Click on apply and then on exit.

1. WRITING TEXT

- Command: Dtext or dt
- Tool bar: draw text single line text

➤ Dtext / justify / style <start point> pick a point rotation angle <0> Enter angle for text line. Type the text required.

2. JUSTIFY

- Specify the start point of text or (justify/style) enter an option
- Align/fit/centre/middle/right/TL/TC/TR/ML/MC/MR/BL/BC/BR; Enter any one of option for text.

3. ALIGN

- Specify both text height and text orientation by designating the end point of base line.

4. FIT

- Specified text will fit in the specified area and at an orientation defined with two points and a height.
- Specify first end point of the base line: specify a point (1)
- Specify second end point of the base line: specify a point (2).

5. CENTRE

- Aligns the text from horizontal centre of base line, which you specify with points.
- Centre points: pick centre point for text line
- Rotation angle: specify the angle for text base line.
- Text: type the text and press

6. MIDDLE

- The selected midpoint is the exact midpoint of the text.
- Midpoint: pick a point.
- Rotation angle: specify an angle for line, enter text
- Right: The picked point will be extreme right end of text extend
- End point: Pick right end for text
- Rotation angle: specify an angle
- Text: type the text required

7. OTHER OPTIONS

- Other points are TL,TC,TR the texts are aligned with the top of text box and ML,MC,MR are the text which are aligned with a middle of text box and BL,BC,BR are the text which are aligned with bottom of text box.
- Multi line text:
- Command: mtext
- Tool bar: Multiline text
- It is a text in which the single style of text colour, its height can be adjusted according to the requirement. The arrangement will be displayed.
- Style: Select the style name.
- Font: Select the font style
- Height: set the height of letters
- We can even select the style of letter < bold/italic/underline>. We can select the colour required also.

8. HATCHING:

- Hatches are shaded pattern which generally represents a cross section of component or object.
- Command: H
- Hatch tab: define the appearance of hatch pattern to be applied.
- Type: sets the pattern type. User defined patterns are based on current line type in user drawing.

9. PATTERN:

- List the available pre defined patterns. The fix most recently used pre defined patterns appears at the top of list.

10. SWATCH:

- Displays a previous selected pattern, you can click the swatch display the hatch pattern box.

11. ANGLE:

- Specify an angle for the hatch pattern, relative to the x axis of current use.

12. SCALE:

- You can add, delete and rename the layers change their properties and set layer property for layout view ports or add layers descriptions and apply changes.

13. SPACING:

- It specifies spacing of line in a used defined pattern.

14. LAYER:

- Layers are used to group information I a drawing, foundation and reinforcement line type, colour and other standards. Layers are equivalent to overlays used in paper based drafting. Layer is the primary organizational tool used in drawing. You can turn off the layers that you don't need and plot a drawing containing only the required information. You can add, delete and rename the layers change their properties and set layer property for layout view ports or add layers descriptions and apply changes.
- Layer filter controls the layers displayed and can also used to make changes to more than one layer at a time.

Function key Function defined in AutoCAD

F1 -Online help

F2 -Toggles between command window on and off

F3 -Toggles between OSNAP on and off

F4 -Toggles between Tablet on and off

F5 -Switches among Isoplanes Top, Right and Left

F6 -Toggles between co-ordinates on and off

F7 -Toggles between Grid on and off

F8 -Toggles between Ortho on and off

F9 -Toggles between Snap on and off

F10- Toggles between Polar Tracking on and off

F11 -Toggles between Object Snap Tracking on and off

F12 -Dynamic Input on and off

LEARNING OUTCOMES :

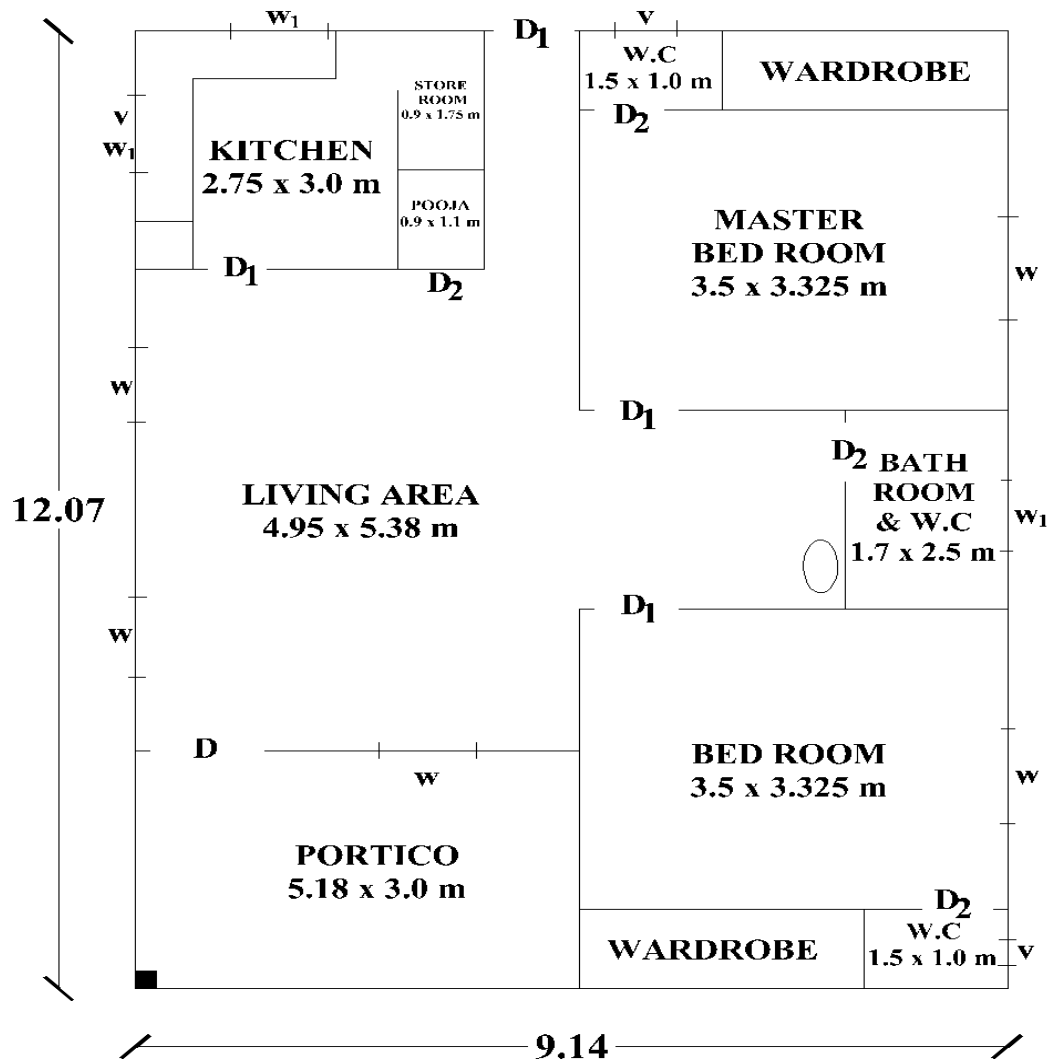
- Knowledge about basic commands and its usage of AutoCAD software

APPLICATION AREAS:

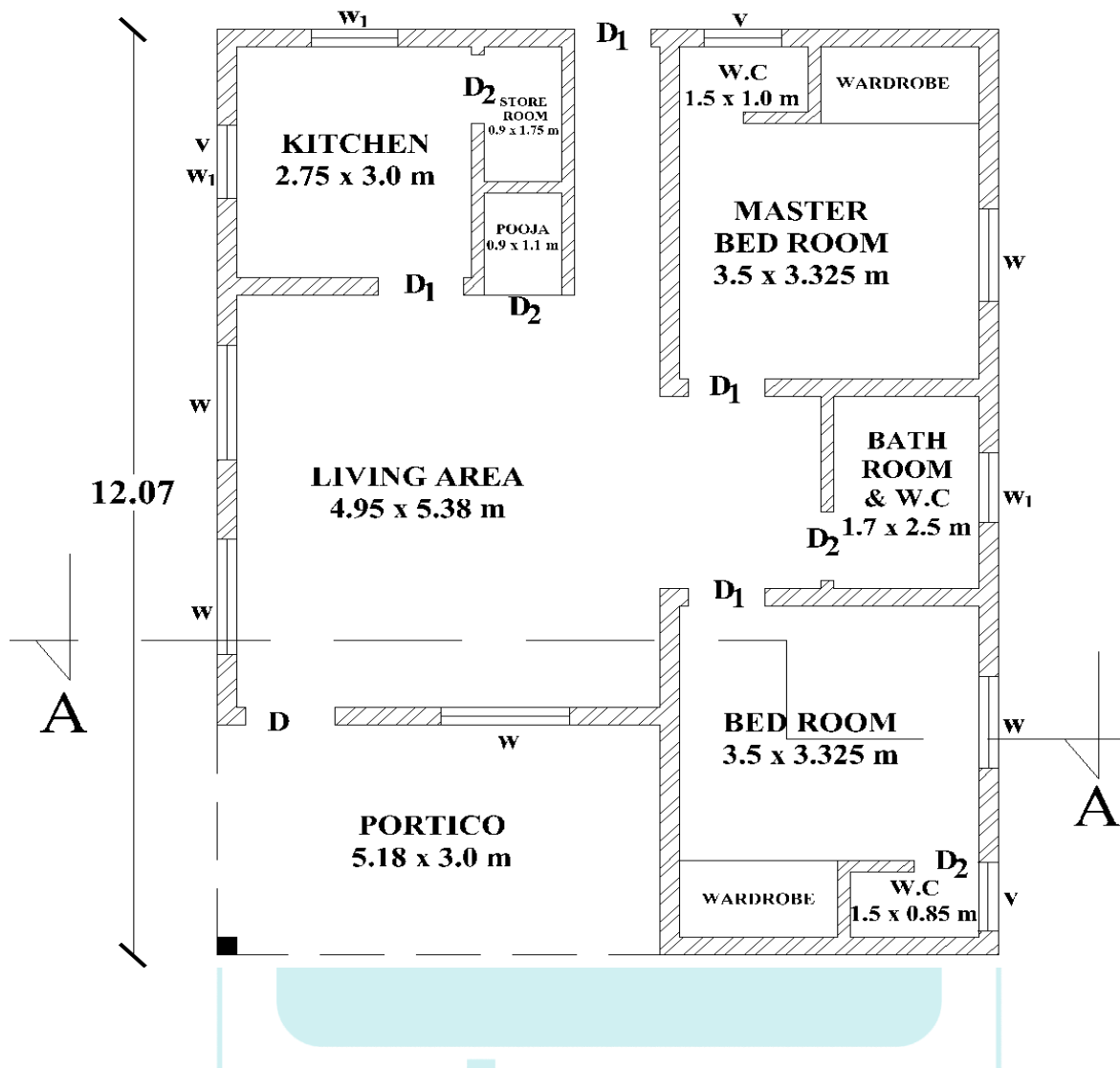
- Drafting
- Modelling

Residential plan: Detailed plan with rooms, doors/windows (standard sizes: doors 900x2100mm, windows 1200x1200mm), furniture blocks, dimensions 1:100 scale.

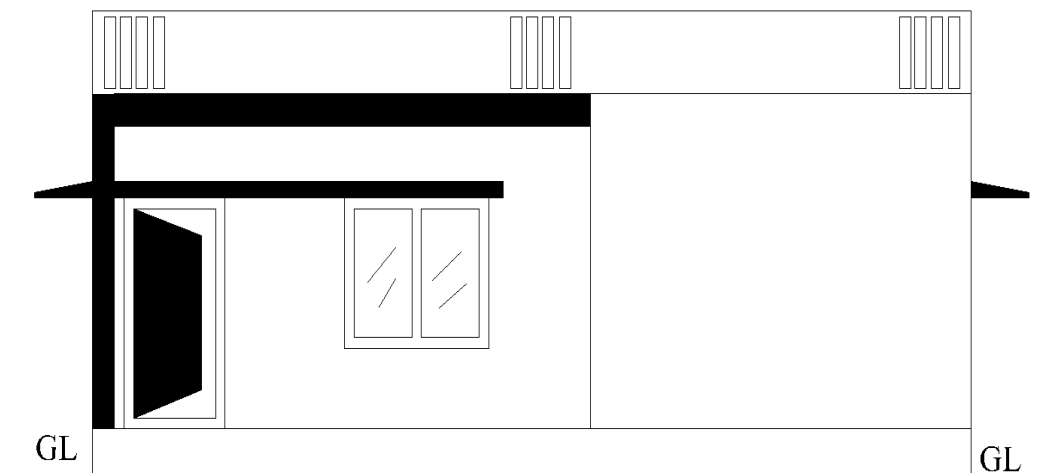
LINE DIAGRAM OF SINGLE STOREY RESIDENTIAL BUILDING



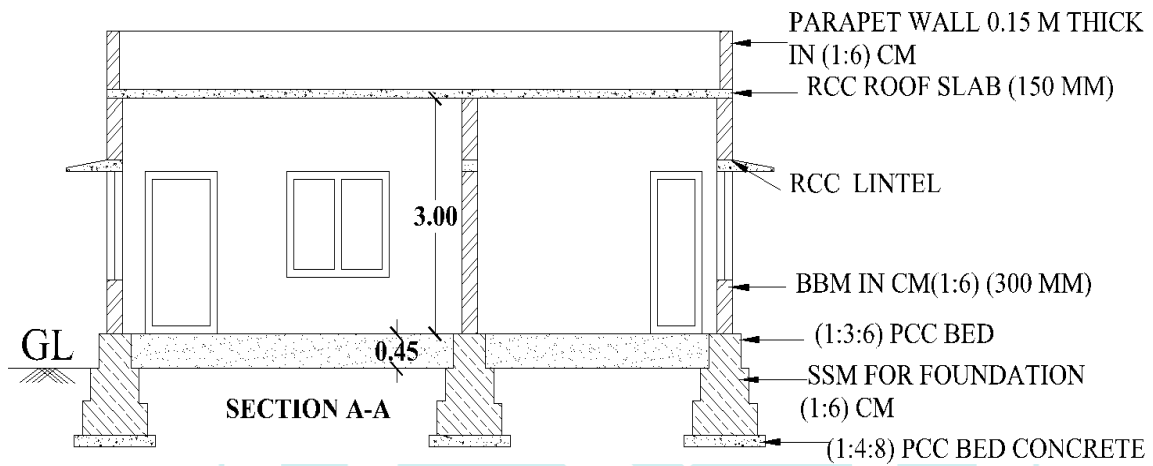
PLAN OF SINGLE STOREY RESIDENTIAL BUILDING



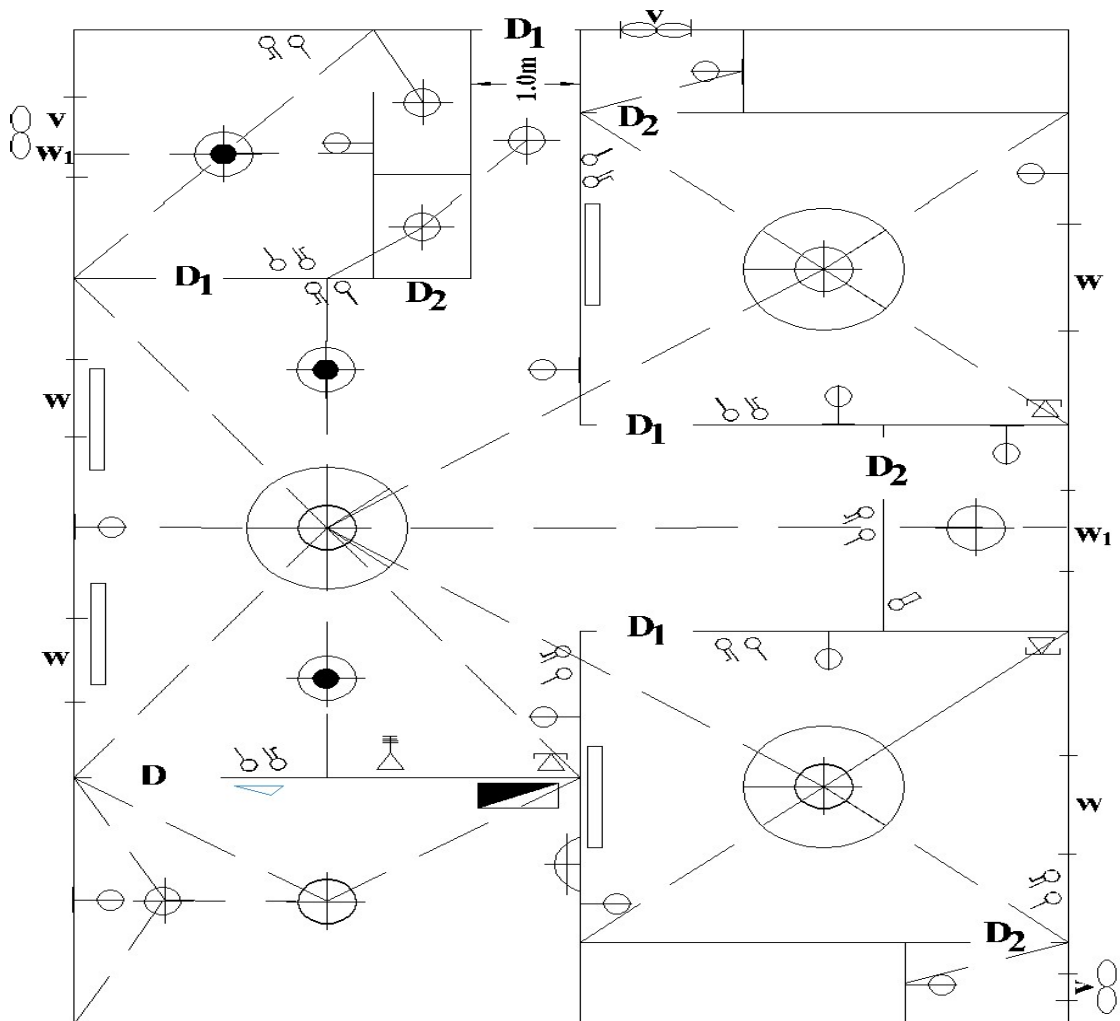
FRONT ELEVATION OF SINGLE STOREY RESIDENTIAL BUILDING



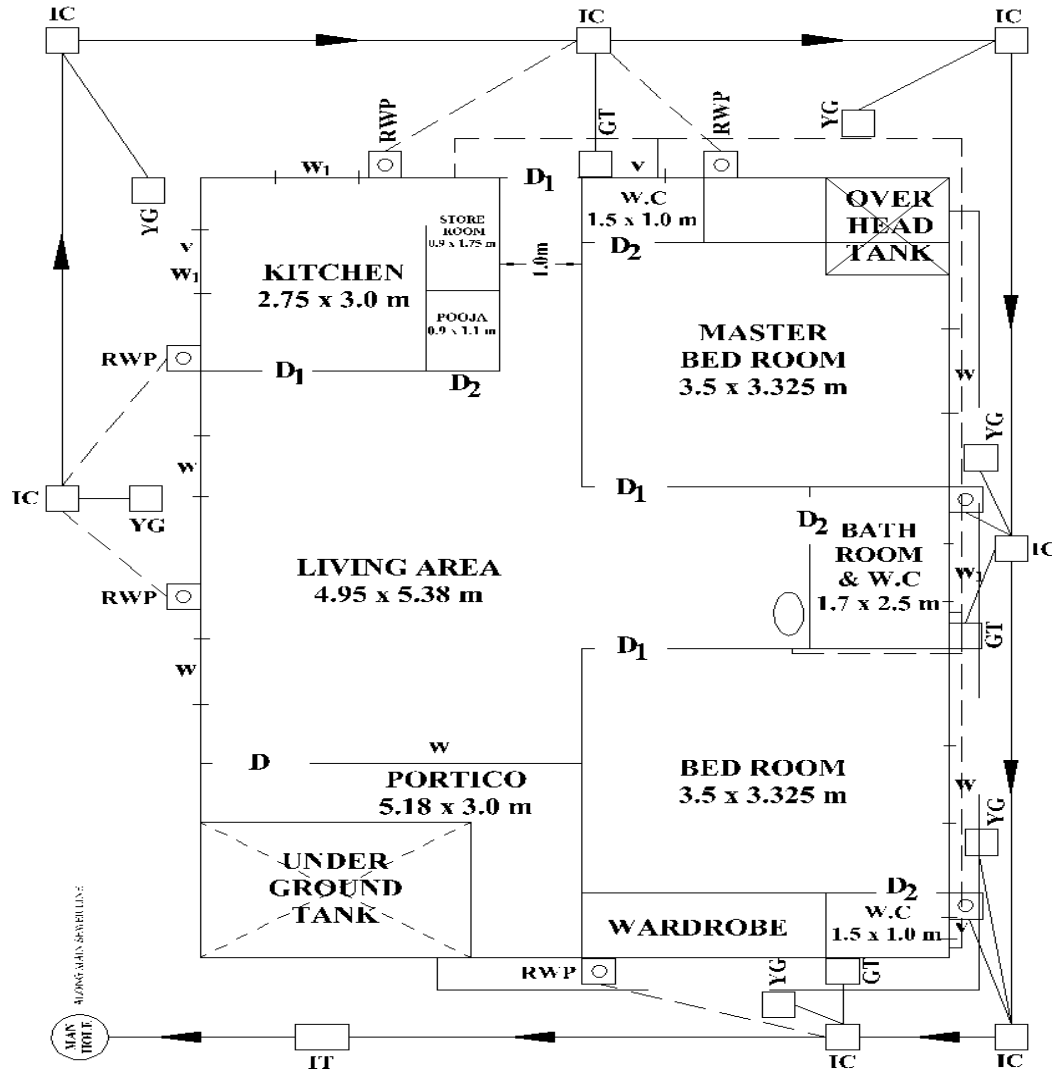
CROSS SECTION OF SINGLE STOREY RESIDENTIAL BUILDING



ELECTRICAL SUPPLY FOR SINGLE STOREY RESIDENTIAL BUILDING

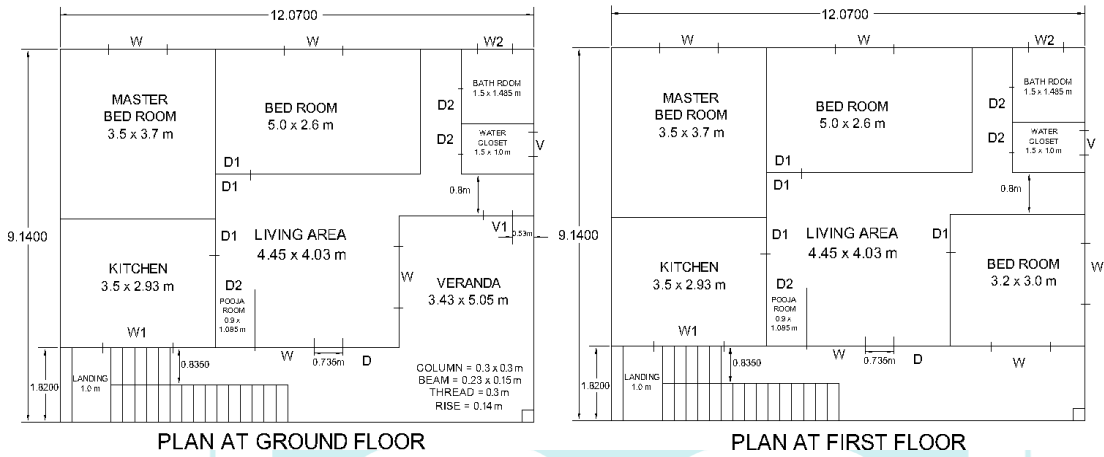


WATER SUPPLY & SANITARY CONNECTION FOR
SINGLE STOREY RESIDENTIAL BUILDING

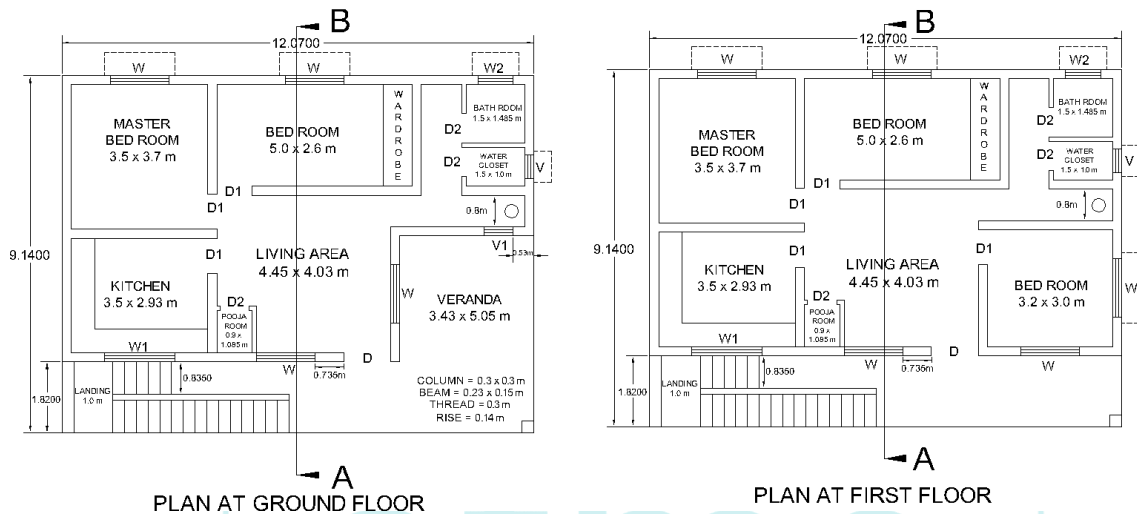


Residential elevation/section: Matching elevation, cross-section with hatching (walls 230mm brick, slab 150mm), stairs, roof.

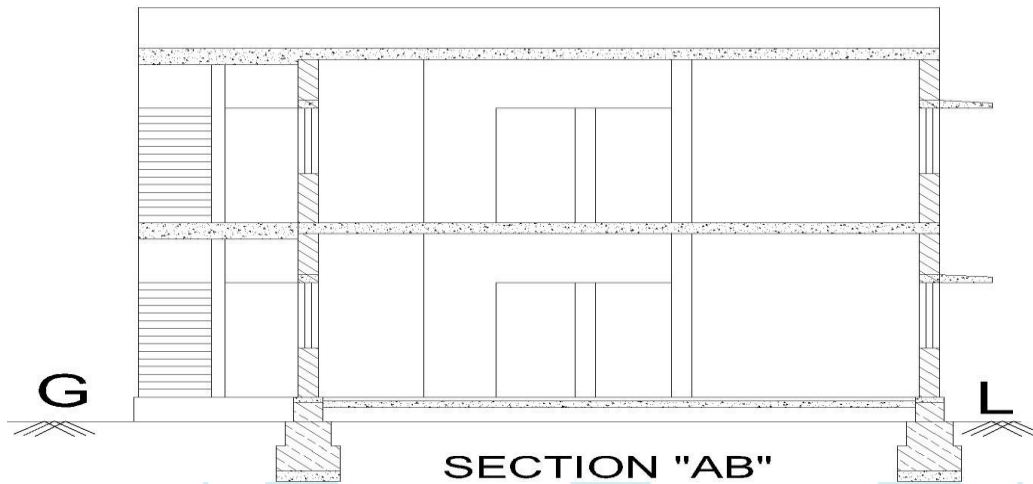
LINE DIAGRAM OF TWO STOREY RESEDENTIAL BUILDING



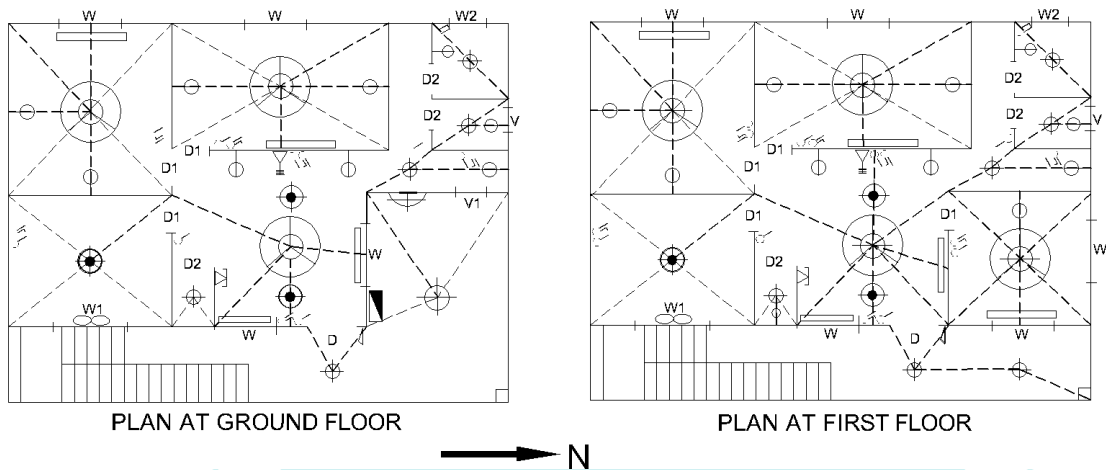
PLAN OF TWO STOREY RESEDENTIAL BUILDING



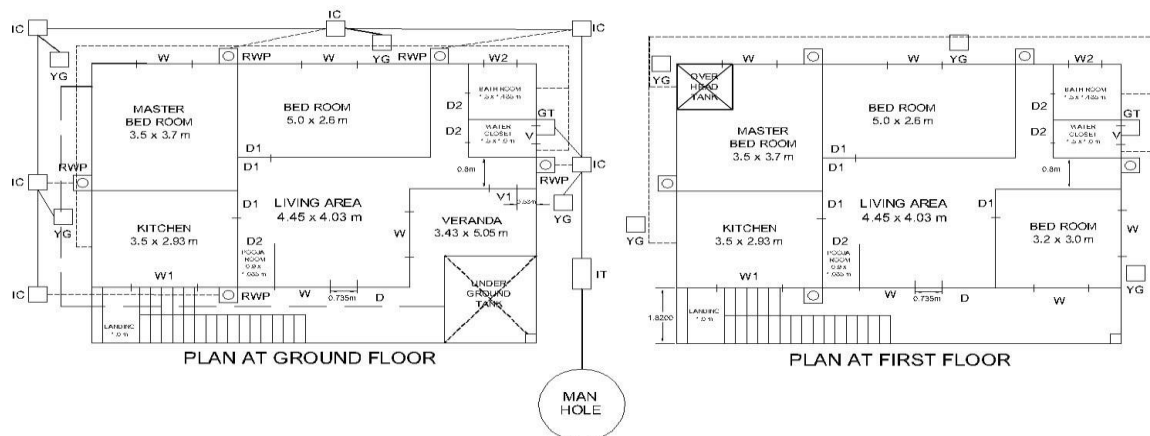
CROSS SECTION OF TWO STOREY RESEDENTIAL BUILDING



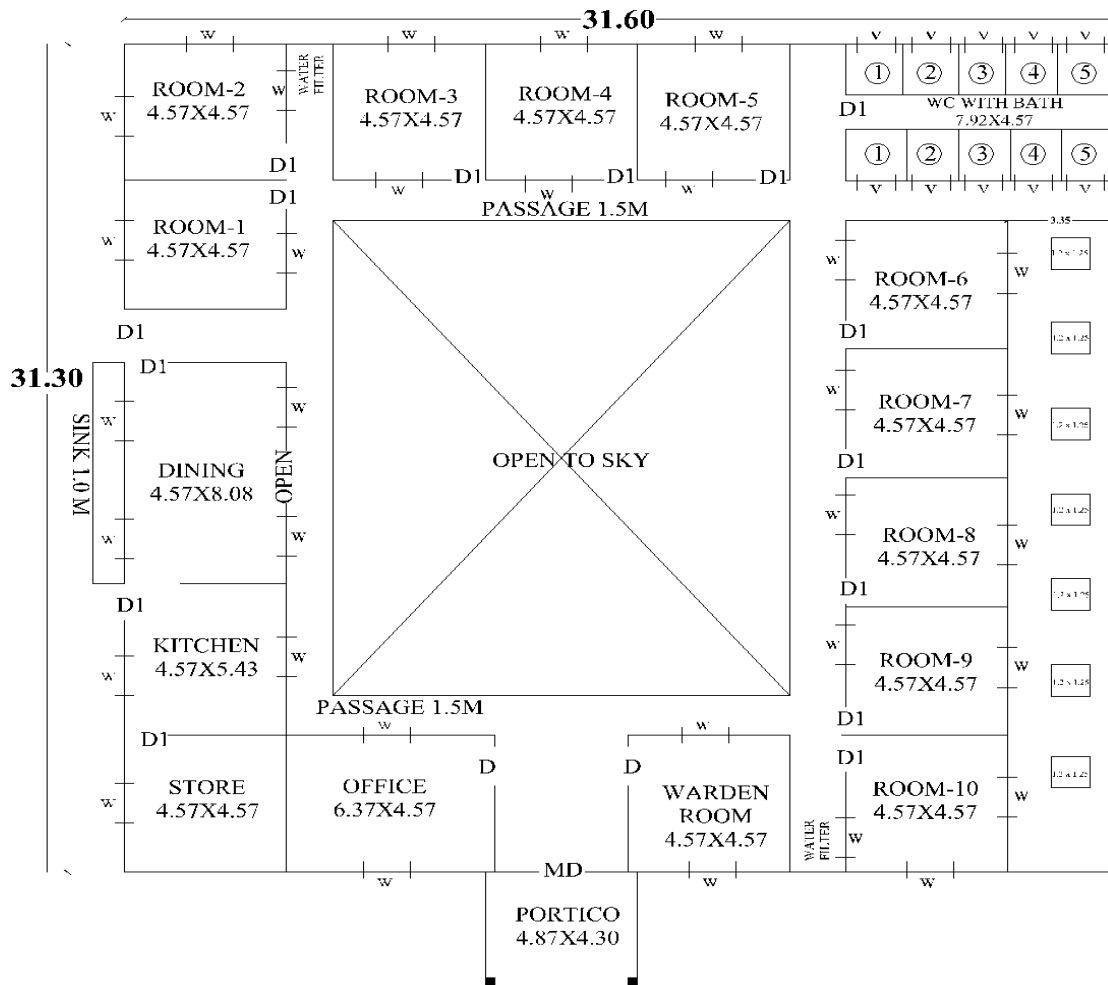
ELECTRICAL SUPPLY FOR TWO STOREY RESEDENTIAL BUILDING



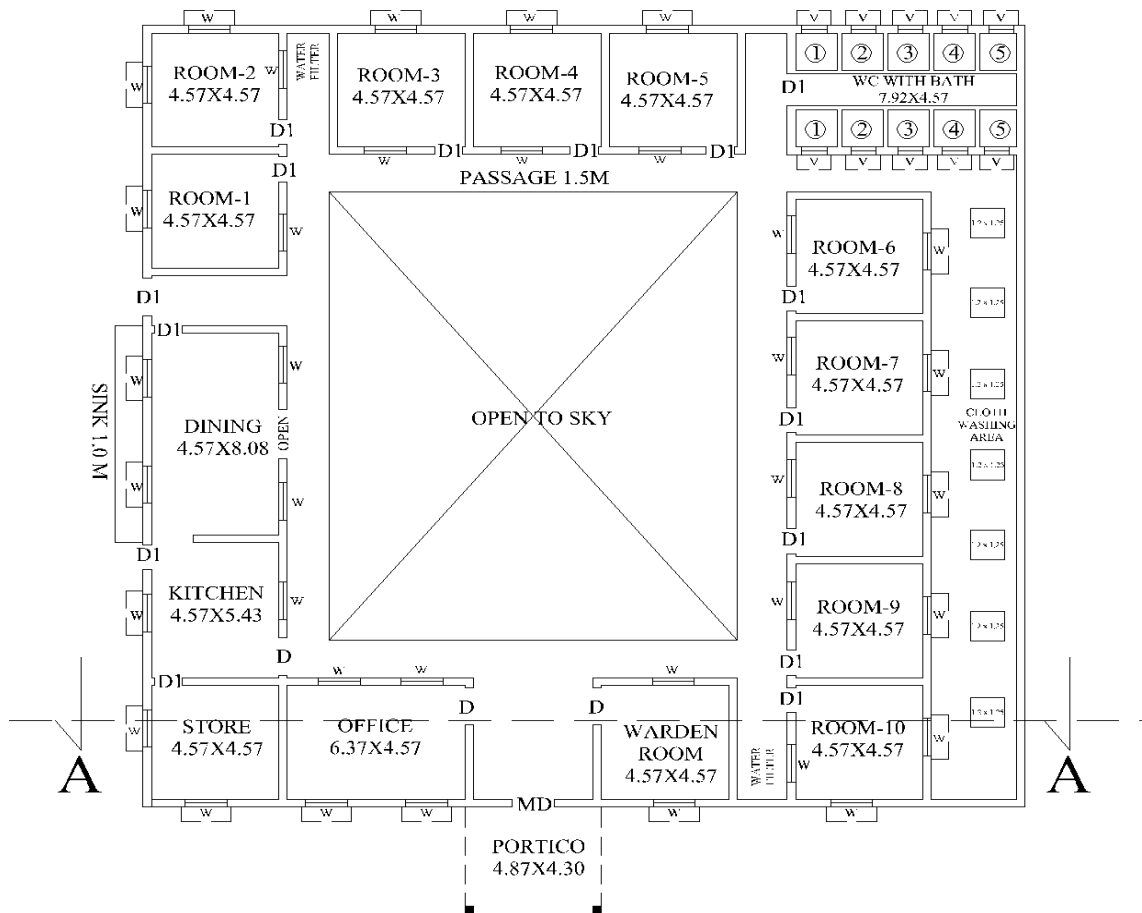
WATER & SANITARY SUPPLY CONNECTION FOR TWO FLOORS BUILDING



LINE DIAGRAM OF HOSTEL BUILDING



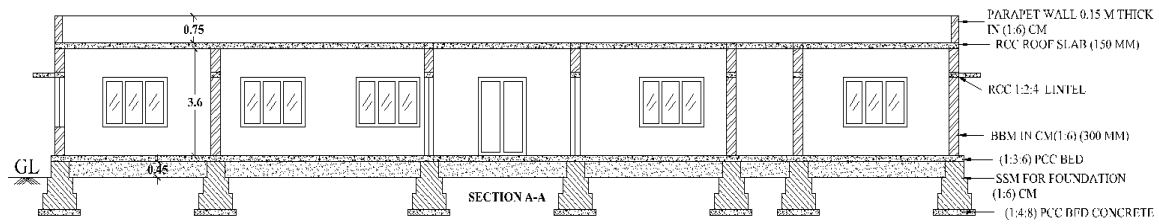
PLAN OF HOSTEL BUILDING



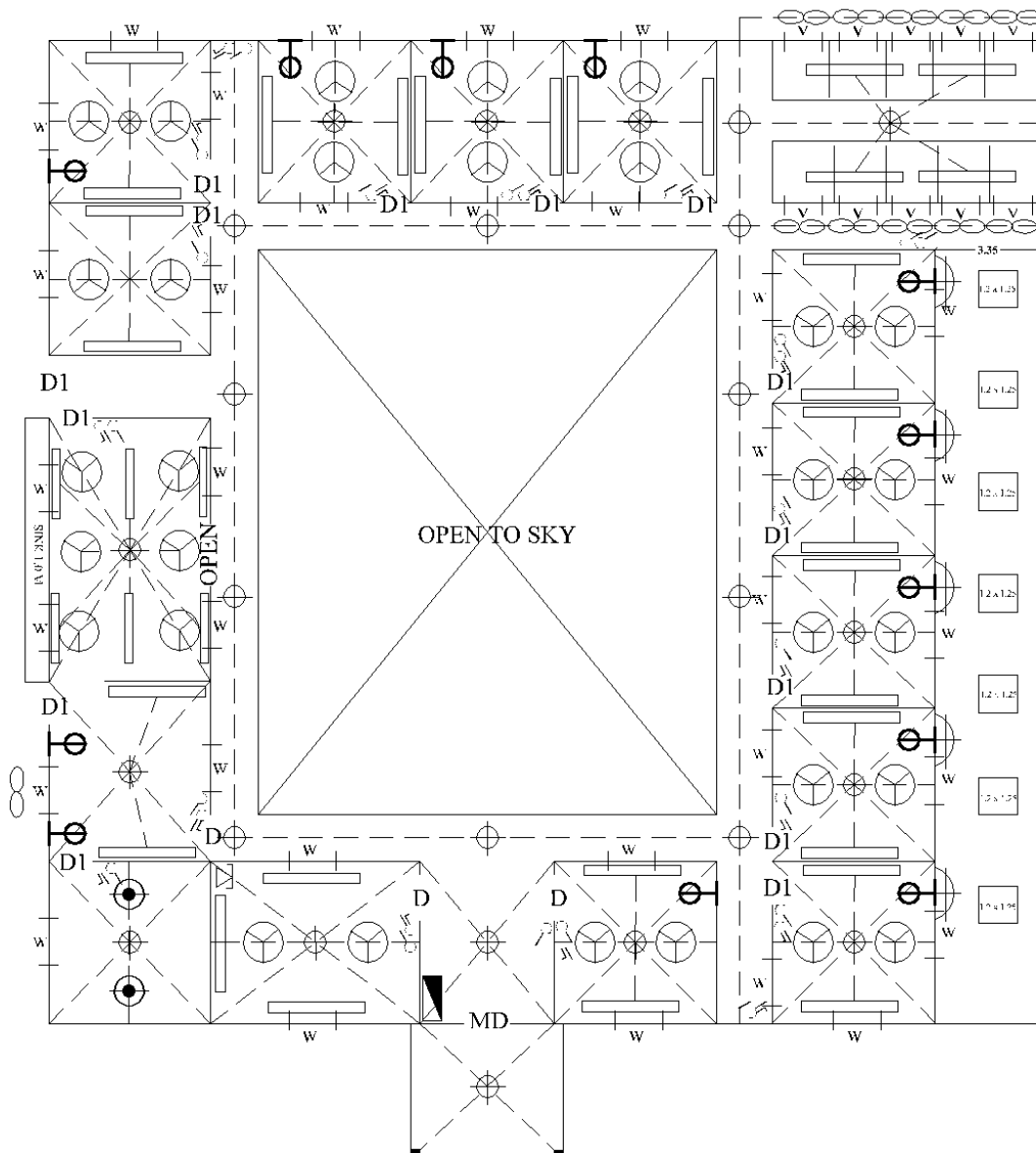
FRONT ELEVATION OF HOSTEL BUILDING



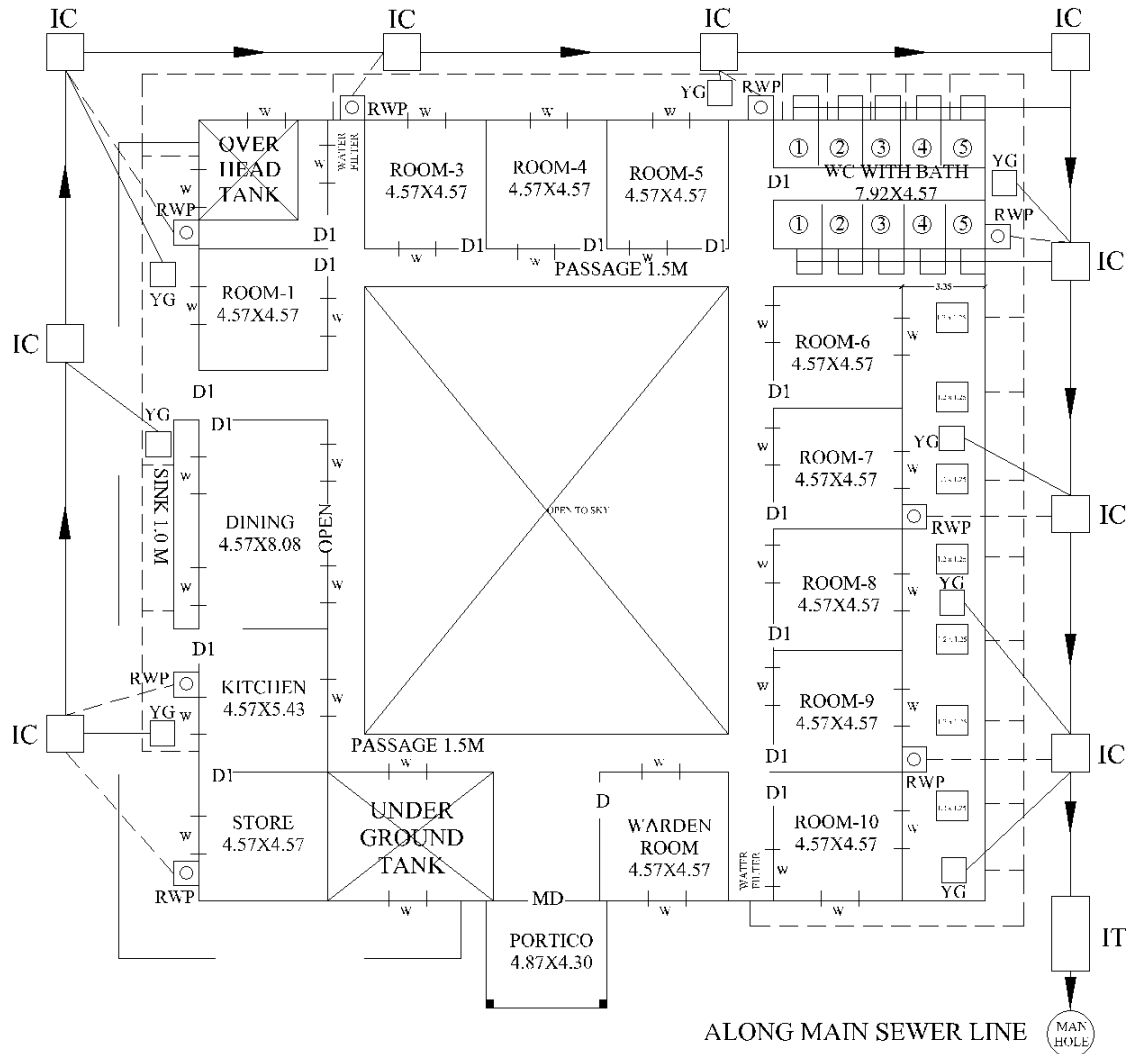
CROSS SECTION OF HOSTEL BUILDING



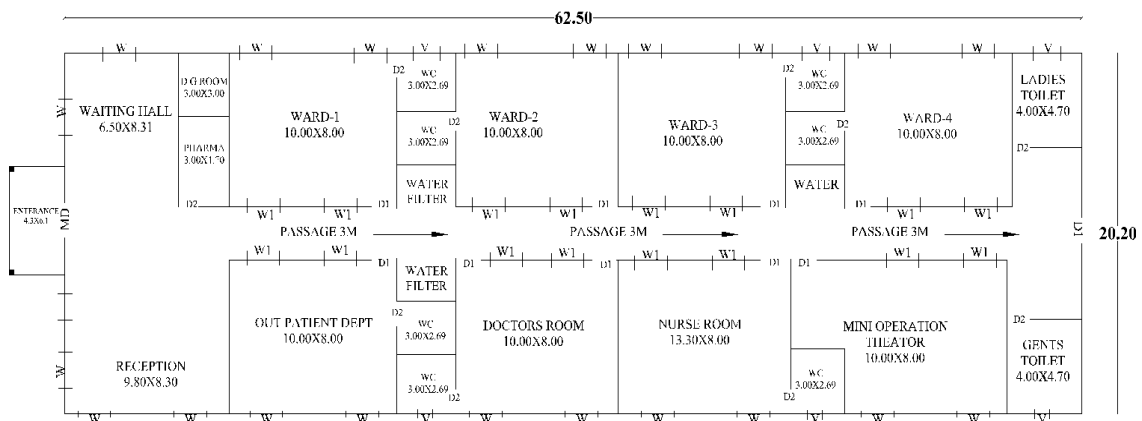
ELECTRICAL SUPPLY FOR HOSTEL BUILDING



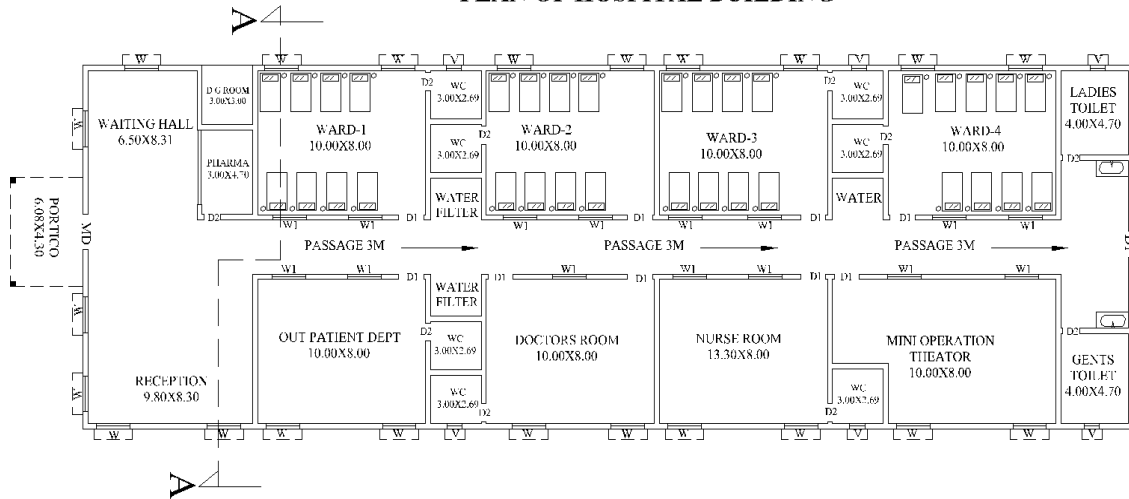
WATER SUPPLY & SANITARY CONNECTION FOR HOSTEL BUILDING



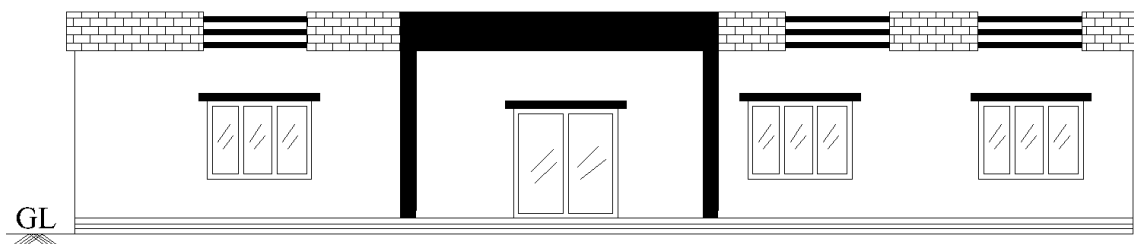
LINE DIAGRAM OF HOSPITAL BUILDING



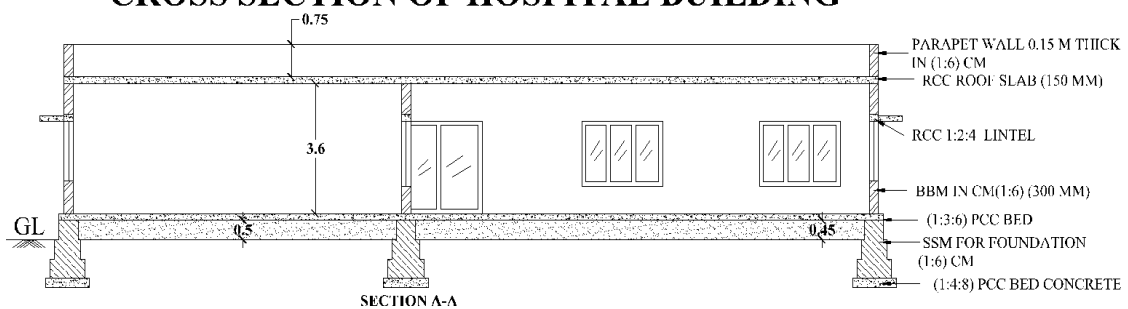
PLAN OF HOSPITAL BUILDING



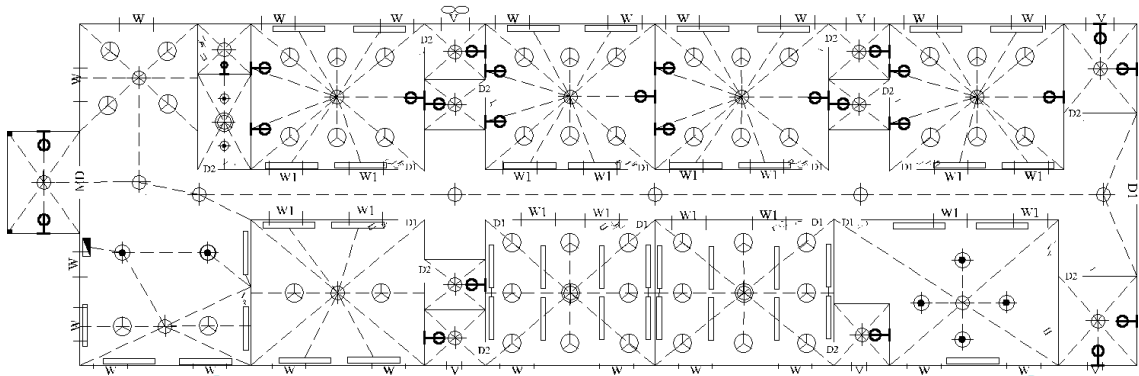
FRONT ELEVATION OF HOSPITAL BUILDING



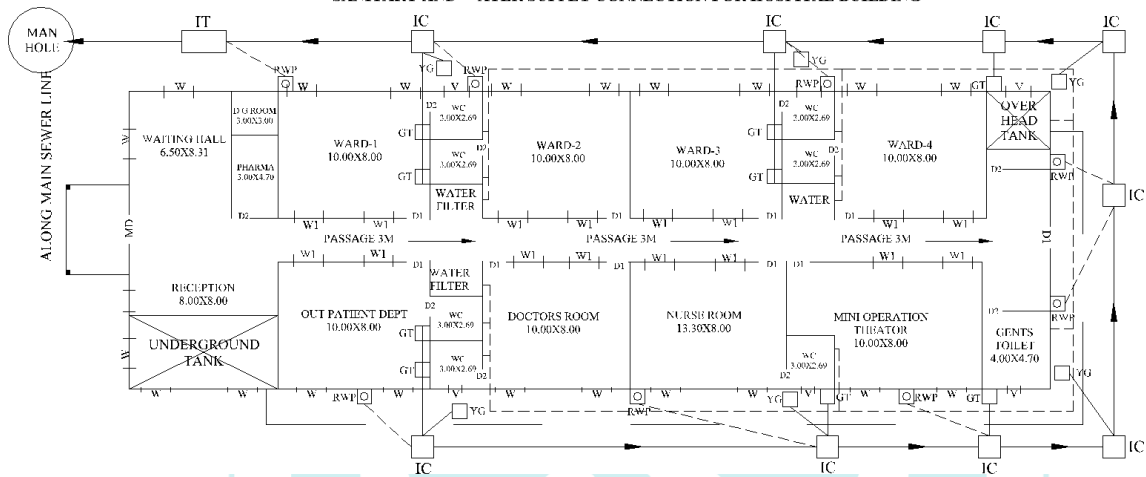
CROSS SECTION OF HOSPITAL BUILDING



ELECTRICAL SUPPLY FOR HOSPITAL BUILDING



SANITARY AND WATER SUPPLY CONNECTION FOR HOSPITAL BUILDING



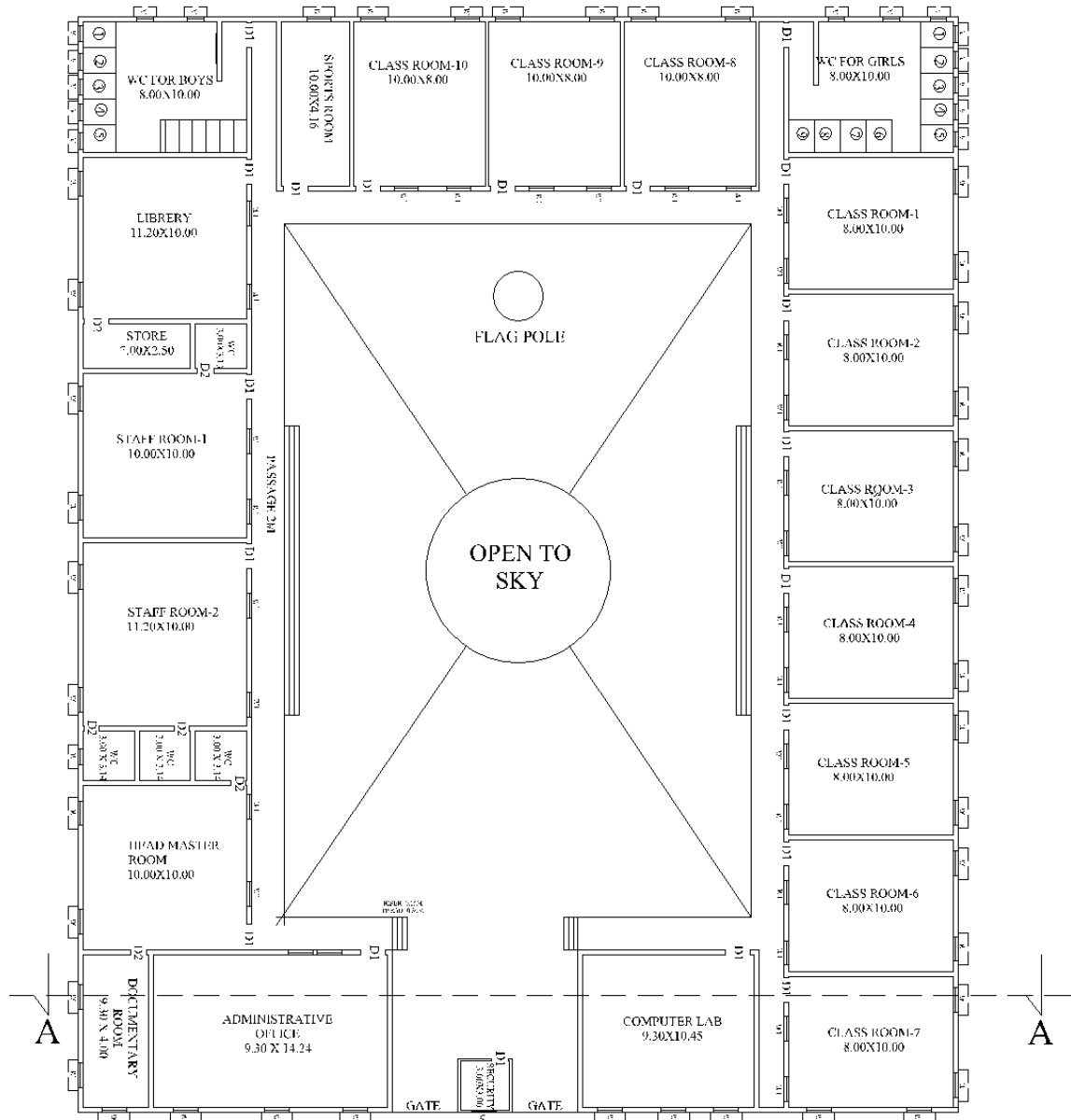
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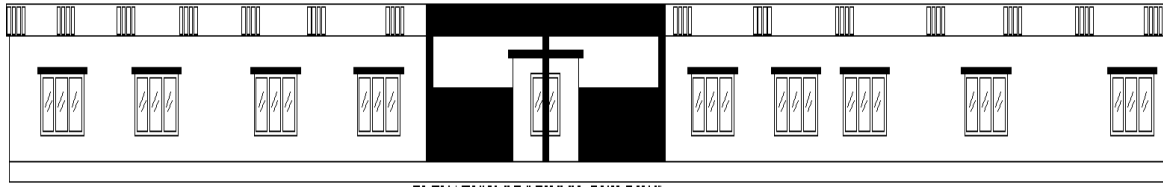
[illegible]

School elevation/sections: Front/side elevations, longitudinal section showing plinth (750mm), parapet, solar panels; hatches for materials.

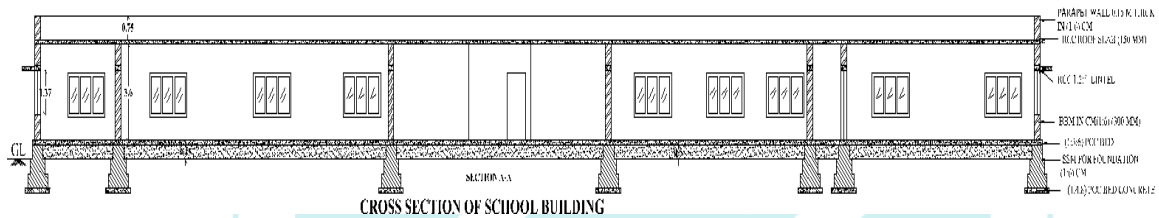
PLAN OF SCHOOL BUILDING



FRONT ELEVATION OF SCHOOL BUILDING



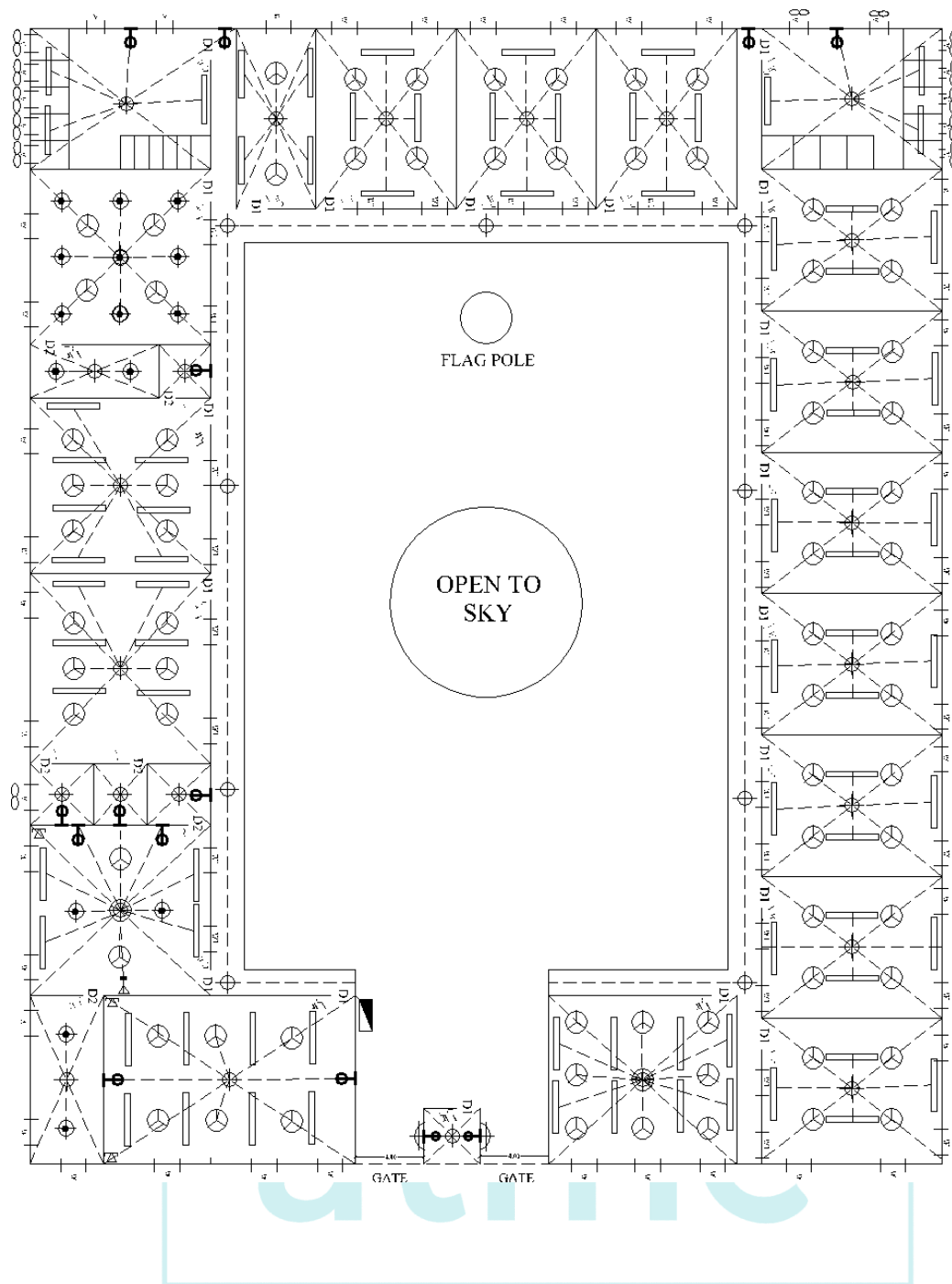
CROSS SECTION OF SCHOOL BUILDING



CROSS SECTION OF SCHOOL BUILDING



ELECTRICAL SUPPLY FOR SCHOOL BUILDING



SANITARY AND WATER SUPPLY CONNECTION FOR HOSPITAL BUILDING

