

**ATRIA INSTITUTE OF TECHNOLOGY
BANGALORE**



DEPARTMENT OF CIVIL ENGINEERING

III Semester BE Civil Engineering

COMPUTER AIDED BUILDING PLANNING AND DRAWING

(18CVL37)

TITLE OF THE COURSE: COMPUTER AIDED BUILDING PLANNING AND DRAWING
B.E., III Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	18CVL37	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 04

Course Objectives: Provide students with a basic understanding

1. Achieve skill sets to prepare computer aided engineering drawings
2. Understand the details of construction of different building elements.
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

Module-1

Drawing Basics: Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962.

Simple engineering drawings with CAD drawing tools: Lines, Circle, Arc, Poly line, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, Working with multiple drawings.

12 Hours L1,L2

Module-2

Drawings Related to Different Building Elements:

Following drawings are to be prepared for the data given using CAD Software

- a. Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings.
- b. Different types of bonds in brick masonry
- c. Different types of staircases – Dog legged, Open well
- d. Lintel and chajja
- e. RCC slabs and beams
- f. Cross section of a pavement
- g. Septic Tank and sedimentation Tank
- h. Layout plan of Rainwater recharging and harvesting system
- i. Cross sectional details of a road for a Residential area with provision for all services
- j. Steel truss (connections Bolted)

Note: Students should sketch to dimension the above in a sketch book before doing the computer drawing

12 Hours L2,L3,L4,L5,L6

Module-3

Building Drawings: Principles of planning, Planning regulations and building bye- laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.

Drawing of Plan, elevation and sectional elevation including electrical, plumbing and sanitary services *using CAD software* for:

1. Single and Double story residential building
2. Hostel building
3. Hospital building
4. School building
5. Submission drawing (sanction drawing) of two storied residential building with access to terrace including all details and statements as per the local bye-laws

Note:

- Students should sketch to dimension the above in a sketch book before doing the computer drawing
- One compulsory field visit/exercise to be carried out.
- Single line diagrams to be given in the examination

26 Hours L2,L3, L4, L5, L6

Course outcomes: After studying this course, students will be able to

1. Gain a broad understanding of planning and designing of buildings
2. Prepare, read and interpret the drawings in a professional set up.
3. Know the procedures of submission of drawings and Develop working and submission drawings for building
4. Plan and design a residential or public building as per the given requirements

Question paper pattern:

- There will be two full questions with sub divisions if necessary from Module 2 with each full question carrying thirty marks. Students have to answer one question.
- There will be two full questions from Module 3 with each full question carrying fifty marks. Students have to answer one question.
- The conduction of examination and question paper format of should be in lines of 1st year CAED drawing. It's a drawing paper but the exam will be conducted by batches in the computer labs. question papers should be given in batches

Text Books:

1. MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing" , Tata Mc Graw Hill Publishing co. Ltd., New Delhi
2. Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
3. Malik R S and Meo G S, "Civil Engineering Drawing", Asian Publishers/Computech Publications Pvt Ltd.

Reference Books:

1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.,
2. IS: 962-1989 (Code of practice for architectural and building drawing)
3. National Building Code, BIS, New Delhi.

ATRIA INSTITUTE OF TECHNOLOGY BANGALORE-560024

DEPARTMENT OF CIVIL ENGINEERING

LABORATORY CERTIFICATE

This is to certify that.....(U.S.N.....)has satisfactorily completed the course of experiments related to **COMPUTER AIDED BUILDING PLANNING AND DRAWING (18CVL37)** prescribed by the Visvesvaraya Technological University for **V Semester B.E. (Civil Engineering)** course in the laboratory of this Institute during the year **20 -20** .

Date:

Signature of staff in-charge

Signature of the Head of the Department

MAX MARKS	MARKS AWARDED IN WORDS	IN FIGURES

10CVL58-COMPUTER AIDED DESIGN LAB

PARTICULARS OF EXPERIMENTS CONDUCTED

SL NO	PAGE NO'S	NAME OF THE EXPERIMENT/PARTICULARS	DATE OF CONDUCTION	MARKS AWARDED (MAX MARKS-25)	SIGNATURE OF STAFF - INCHARGE
1		AutoCAD			
2		Cross section of Masonry wall Foundation			
3		Cross section of RCC Isolated footing			
4		Dog-Legged Staircase			
5		Lintel and Chajja			
6		Doubly reinforced Beam			
7		Residential Building			
8		STAAD PRO.			
9		Analysis of Beams			
10		Analysis of Frames			
11		Analysis of Trusses			
12		MS EXCEL			
13		SFD and BMD for cantilever beam subjected to UDL			
14		SFD and BMD for cantilever beam subjected to UVL			
15		SFD and BMD for SS beam subjected to UDL			
16		SFD and BMD for SS beam subjected to UVL			
17		Design of singly reinforced beam			
18		Design of doubly reinforced beam			

SL NO	PAGE NO'S	NAME OF THE EXPERIMENT/PARTICULARS	DATE OF CONDUCTION	MARKS AWARDED (MAX MARKS-25)	SIGNATURE OF STAFF - INCHARGE
19		Computation of earthwork			
20		Design of Horizontal curve by offset method			
21		Design of super elevation			
TOTAL MARKS AWARDED					

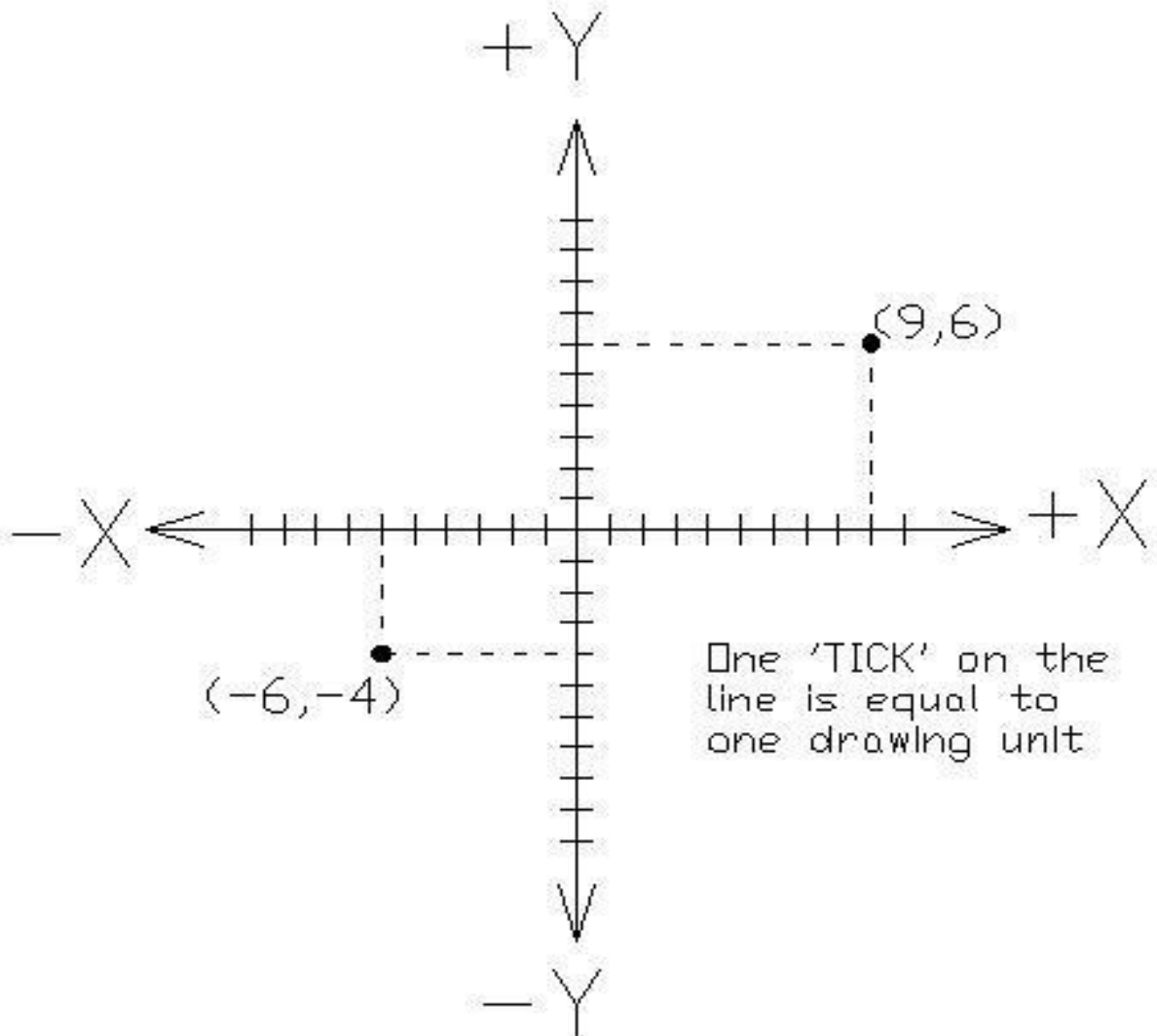
MAX MARKS	
TOTAL MARKS AWARDED	
REDUCED TO 25 MARKS	

AUTOCAD

INTRODUCTION

AutoCAD (Automated computer aided drafting) is the most widely used computer aided drafting package. Over the years AutoCAD has evolved from DOS based command line driven to a full fledged windows application.

AutoCAD gives a very exact and accurate drawing, i.e. It is accurate to 14 decimal points. All the objects drawn on the screen are placed on a simple X, Y coordinate system. In AutoCAD this is known as '**Universal Co-ordinate System**' (UCS). The 3-D drawings have an added Z-axis.



Universal Co-ordinate System (UCS)

Difference between Manual drafting and drafting using AutoCAD.

Sl. No.	Manual Drafting	AUTOCAD Drafting
1	Scale of drawing should be decided before drafting.	First units are decided and then drawing is drafted. Scale can be changed at any point of time.
2	Repetitive drawing and editing tasks must be done manually.	Repetitions and reproductions are done very easily and saves time.
3	Drafter, Pencil, Scale, Compass, Eraser etc are used.	Drawing and modifying tools are used.
4	Less accurate.	Highly accurate.

AutoCAD editor screen

- i. **Drawing/working area:** This is the central space of the screen which is used for creating the drawings.
- ii. **Command bar:** This is the space which is used for typing the AutoCAD commands.
- iii. **Standard tool bar:** This offers quick, single click access to most commonly used AutoCAD features.
- iv. **Status bar :** This gives information at a glance about drawing, co-ordinates and status of grid, ortho, esnap, model and title.
- v. **UCS :** Universal coordinate system provides us with the orientation details of the drawing.
- vi. **Cross hairs :** This helps us to locate the cursor position.

DRAWING TOOLS

- i. **Line:** A line command is used to draw straight line segments of any length, from one point to the next.
- ii. **Circle:** Circle command is used to draw a circle of any radius or diameter.
- iii. **Arc:** Draws a 3-point arc, an arc is a portion of circle therefore it is necessary to provide any three of the following entities viz. start, end, centre and radius.
- iv. **Polyline:** Polylines draw lines similar to the line command, but are a lot more powerful. Though we enter each line end point command separately, because we drew the area with the polyline command left open, AutoCAD treats the polyline as one entity regardless of the shape or direction of the lines.
- v. **Polygon:** This command allows us to create regular polygons (with equal sides and angles). We have the option of inscribing the polygon inside the circle of given radius or we can circumscribe the polygon outside the circle of given radius.
- vi. **Rectangle:** Creates a rectangle by defining two corners. A rectangle can be drawn by either specifying both the length and width or area and length/width.
- vii. **Spline:** draws a spline connecting multiple points.
- viii. **Ellipse:** Ellipse command is used to draw an ellipse using the following options
 - Centre
 - Arc
 - End point axis

MODIFY TOOLS

- i. **Erase:** Erases the selected objects.
- ii. **Copy:** Copies the selected objects from one place to another.
- iii. **Mirror:** Mirrors the objects along the axis defined by us.
- iv. **Offset:** Offsets the objects to the distance you specified by us.
- v. **Array:** Copies selected objects, and arranges them according to a specified pattern. It can be rectangular or Polar.
- vi. **Move:** Moves the selected objects from its original place to the new location as specified by us, along the selected base point.
- vii. **Rotate:** Rotates the object by the specified angle.
- viii. **Scale:** Scales the objects by the ratio we specify.
- ix. **Stretch:** Stretches the selected entities. The entities that can be stretched include the arcs, elliptical arcs, lines, polyline segments, 2D solids, rays traces and splines that crossing the selection window.
- x. **Trim:** Trims the unwanted portions of the objects on specifying.
- xi. **Extend:** Extends the objects to reach specified boundary.
- xii. **Break:** Can break a continuous line into smaller entities.
- xiii. **Chamfer:** Establishes chamfer on lines which are crossed, radiating or unlimited long.
- xiv. **Fillet:** Connects two objects with an arc that is tangent to the objects and has a specific radius

Experiment No. 1

Cross section of Masonry wall Foundation

Aim : To draw simple 2D diagram representing Cross section of masonry wall foundation for the given data.

Data : Draw a C/S of a size stone masonry foundation to be provided for a boundary wall of 230 mm thick burnt brick masonry for a building. Use the following data:

- a. Width of foundation = 800 mm
- b. Depth of foundation below GL = 900mm
- c. Thickness of levelling bed , CC 1:4:8 = 200 mm
- d. Thickness of plinth bed, CC 1:2:4 = 100 mm
- e. Floor level = Ground level
- f. Concrete offset = 100 mm
- g. Masonry offset = 50 mm

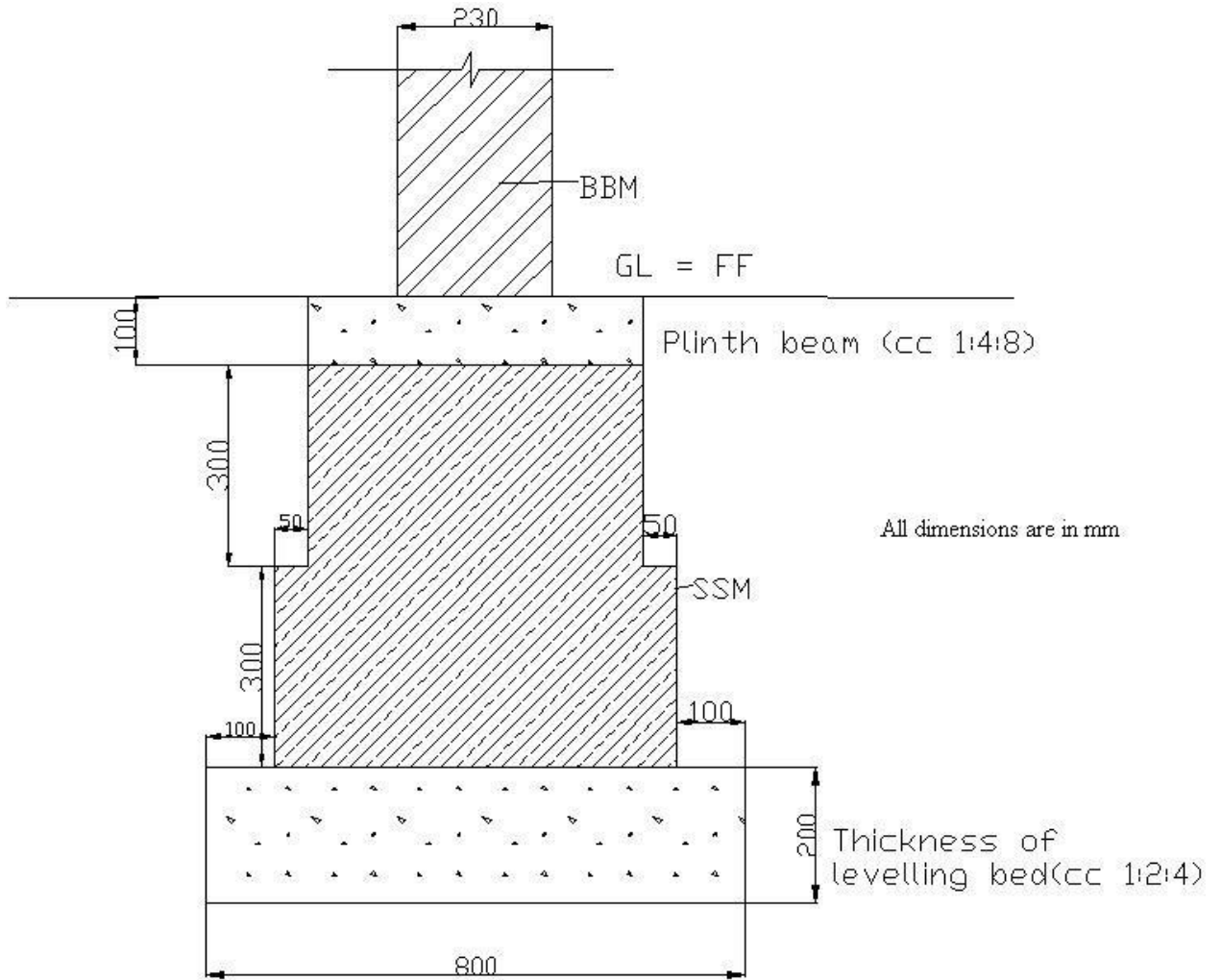
Software used: AUTOCAD

Commands used: Limits, ortho, line, zoom, mirror, move, trim, extend, hatch, dimension, text etc.

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimetres.
- Ortho is switched on as the drawing requires use of only horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Mirror option is used as the drawing is symmetrical about y-axis.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labelling the drawing.

Result: The required cross section of masonry wall foundation is drafted using the software.



SIZE STONE MASONRY FOUNDATION

Experiment No. 2

Cross section of RCC Isolated footing

Aim: To draw simple 2D diagram representing Cross section of RCC Isolated footing for the given data.

Data : Prepare a working drawing for an isolated footing, for a column size 230 X 230 mm reinforced with 4 no. of 16 mm dia HYSD bars, together with 8 mm dia HYSD bars lateral ties @ 230 mm C/C. Footing size =1.8 m X 1.8 m, with the thickness of footing slab 450 mm near the column face & 150 mm along the footing edge. The footing reinforcement consists of 10 mm HYSD bars @ 125 mm C/C in both ways.

- a. Draw the sectional elevation of column & footing.
- b. Draw the sectional plan of column & footing.

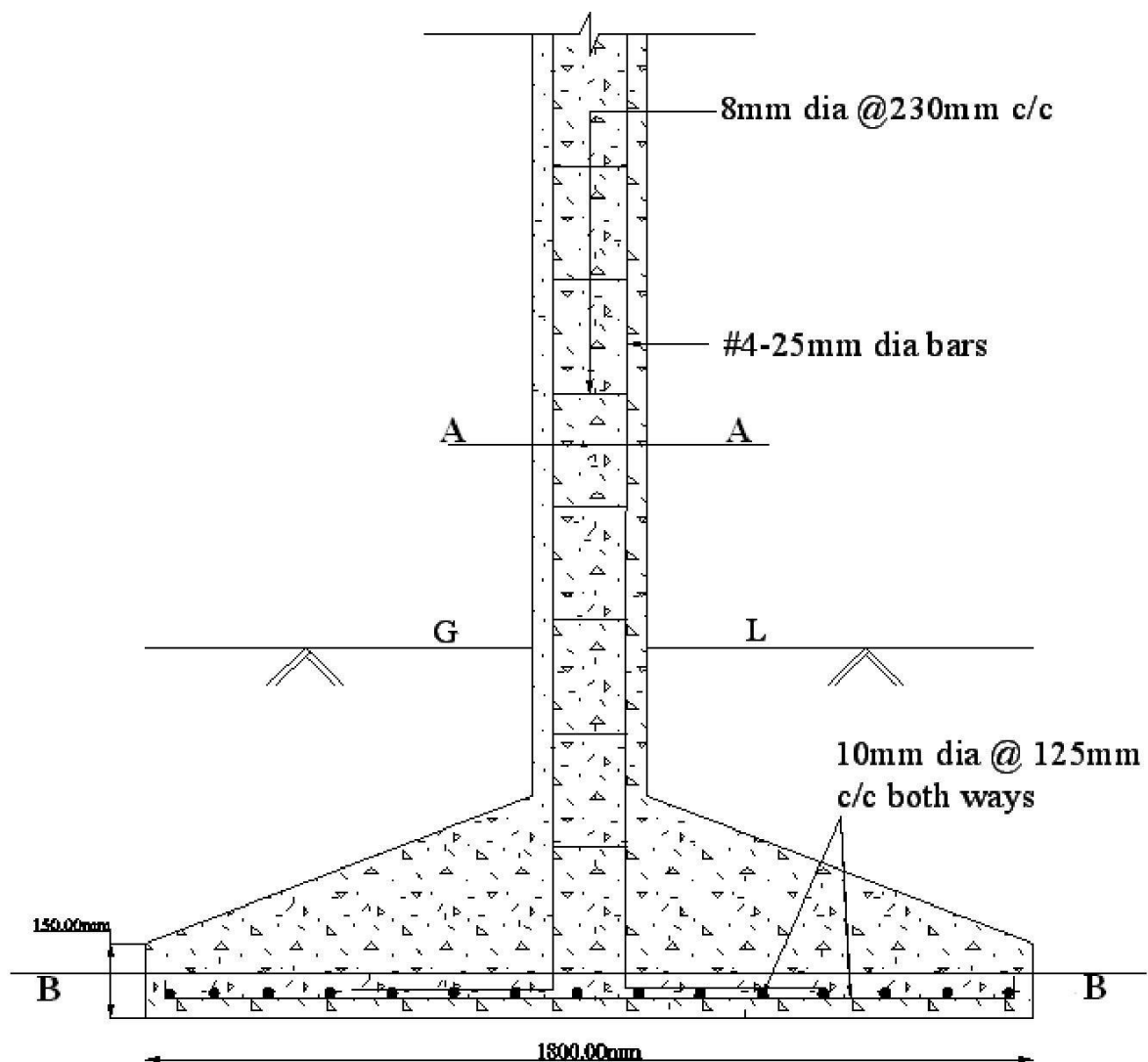
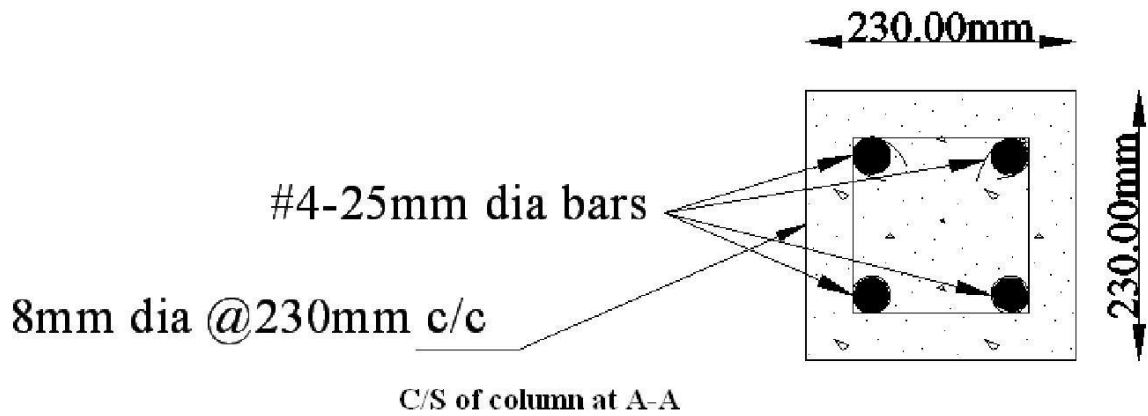
Software used: Auto Cad

Commands used: Limits, ortho, offset, line, array, donut, zoom, mirror, move, trim, extend, hatch, dimension, text etc.

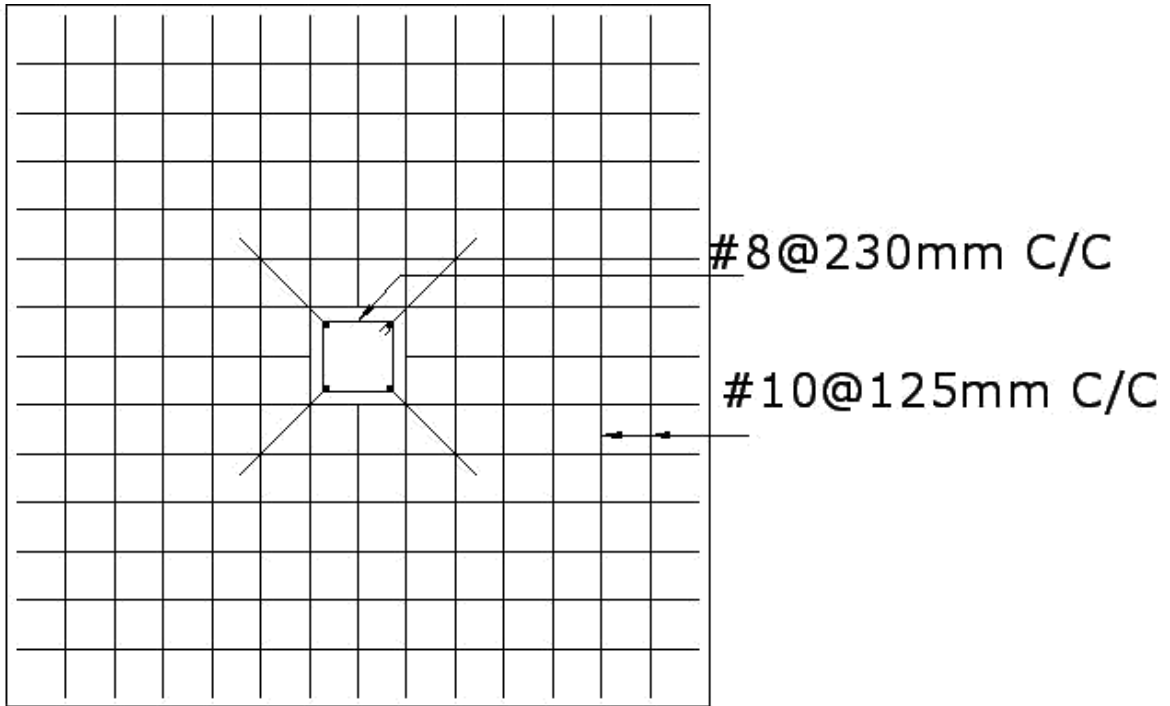
Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimetres.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Mirror option is used as the drawing is symmetrical about y-axis.
- Donut option is used to represent the c/s of reinforcements.
- Array command is used to get reinforcement in linear pattern.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labelling the drawing.

Result: The required cross section of RCC Isolated footing is drafted using the software.



Sectional Elevation



C/S of footing at B-B

Experiment No. 3

Dog-Legged Staircase

Aim : To draw simple 2D diagram representing a dog legged staircase in plan and elevation for the given data.

Data : Draw a C/S & plan of a RCC Dog legged stair case for a building having following particulars:

- a. Clear size of stair hall = 5.5 X 2.2 m
- b. Width of landing = 1 m
- c. Width of each flight = 1 m
- d. Rise = 150 mm & Tread = 300 mm
- e. Waist slab = 150 mm
- f. Height of floor = 3.6 m.

Software used: AUTOCAD

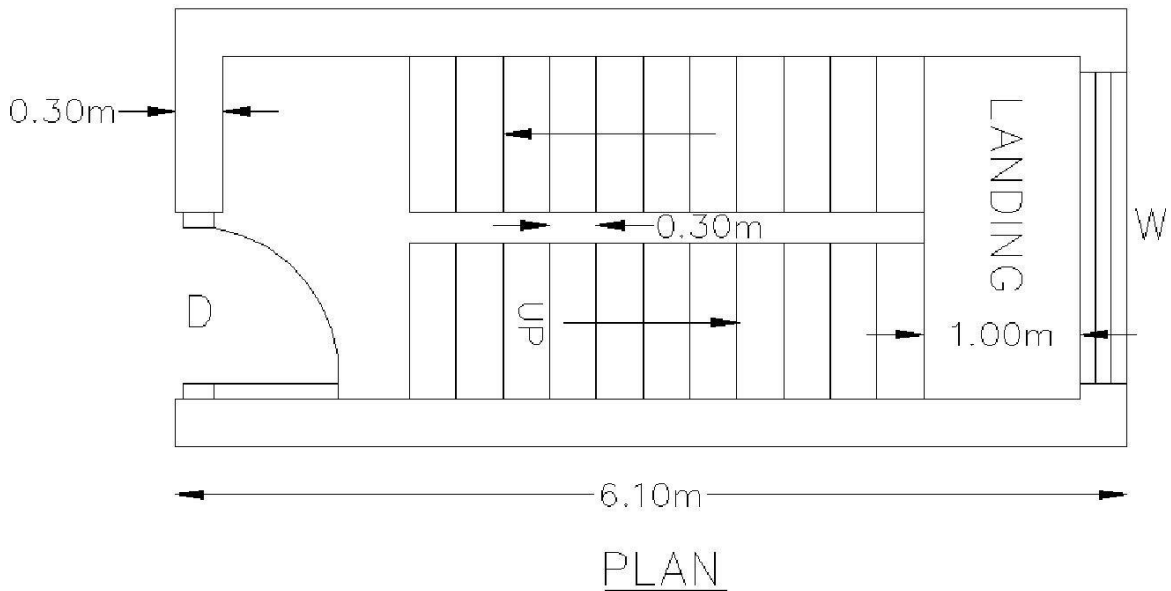
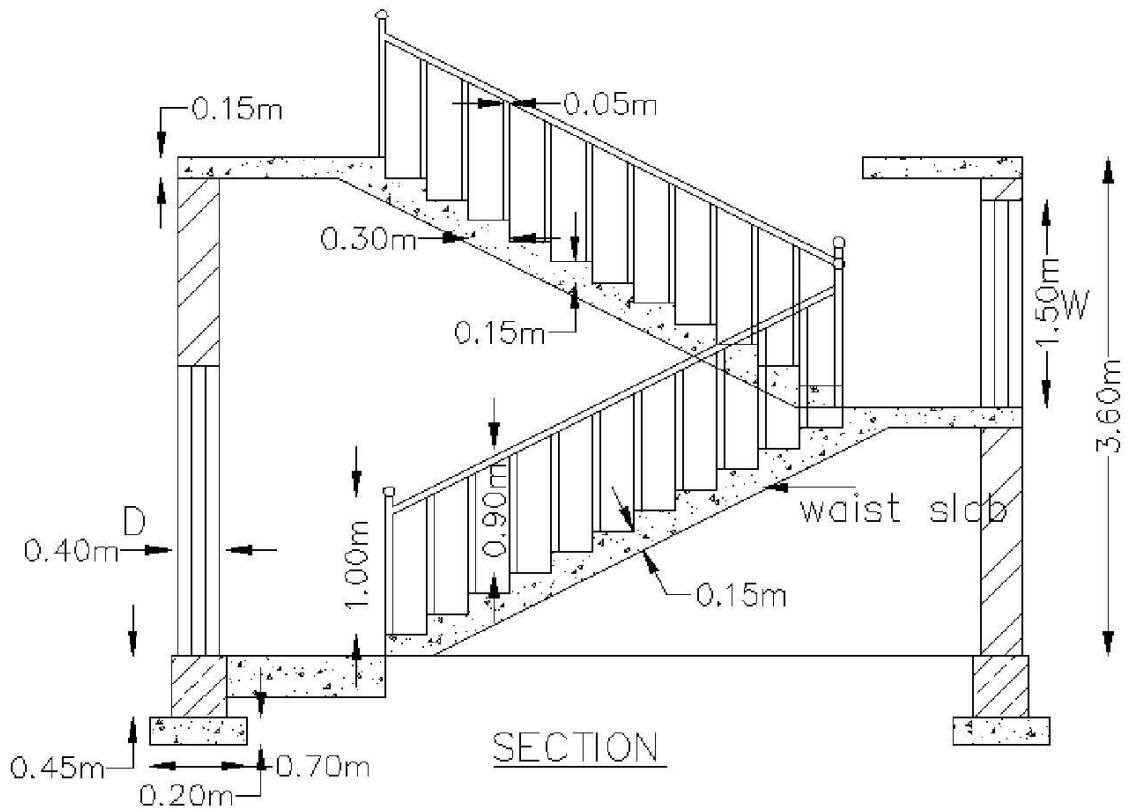
Commands used: Limits, ortho, offset, line, array, zoom, move, trim, extend, hatch, dimension, text etc.

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimetres.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Array command is used to get a pattern of lines for representing staircase treads.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labelling the drawing.

Result: The required dog legged staircase in plan and elevation is drafted using the software.

DOG LEGGED STAIR CASE



Experiment No. 4

Lintel and Chajja

Aim : To draw simple 2D diagram representing the cross section of lintel and chajja for the given data.

Data : Draw a C/S of lintel and chajja having following particulars:

- a. Wall thickness of 300 mm
- b. Thickness of lintel beam as 400 mm
- c. Main reinforcement of lintel 2 of 10 mm ϕ bar at top and bottom
- d. 2 legged stirrups 8 mm ϕ bars at 200 mm C/C
- e. Main reinforcement for chajja 100 mm ϕ bars at 150 mm C/C
- f. Distribution bars for chajja as 8 mm ϕ bars at 150 mm C/C
- g. Thickness of chajja as 100 mm away from the face of the wall and 200 mm near the face of the wall.

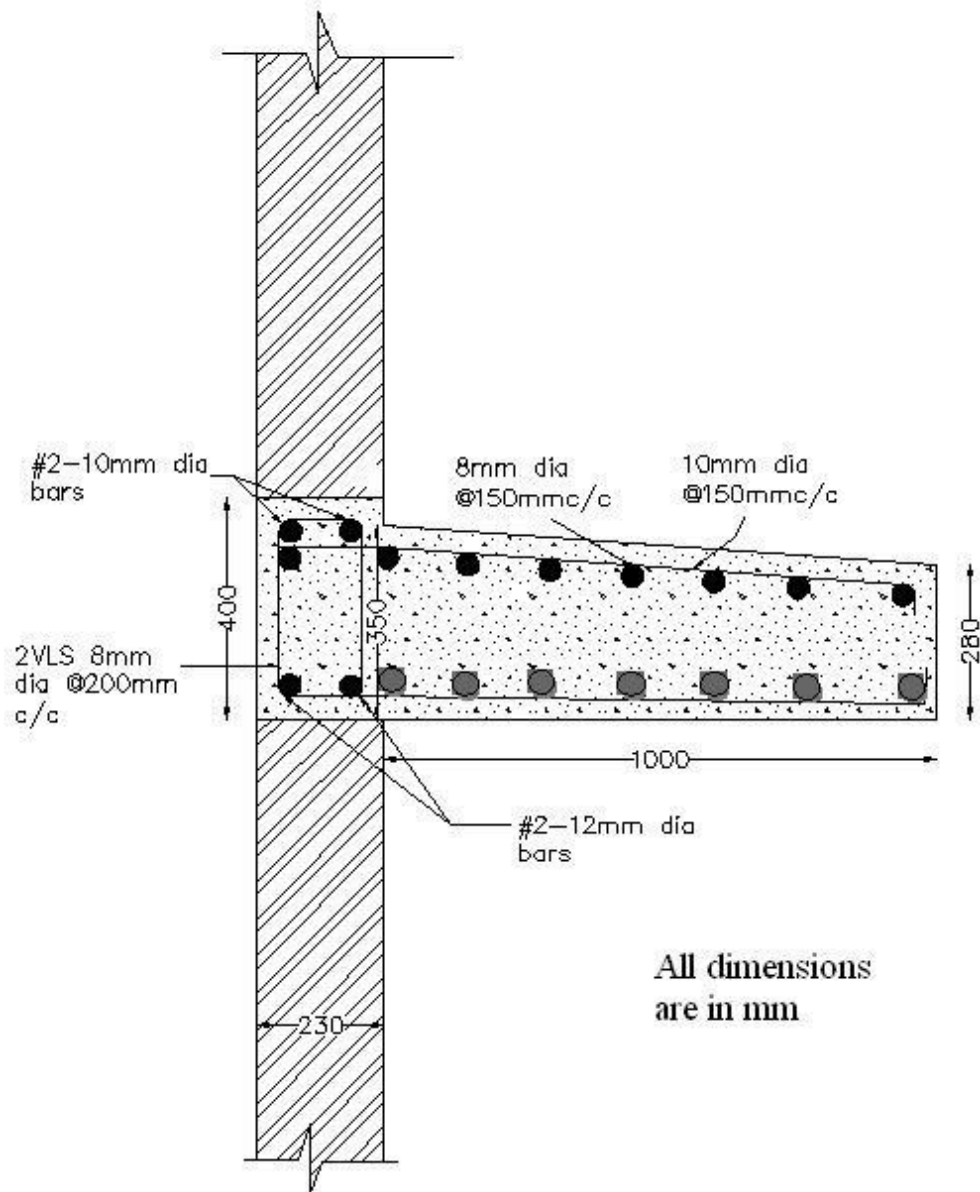
Software used: AUTOCAD

Commands used: Limits, ortho, offset, line, zoom, donut, move, trim, extend, hatch, dimension, text etc.

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimetres.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labelling the drawing.

Result: The required C/S of lintel and chajja is drafted using the software.



Sectional elevation of lintel and chajja

Experiment No. 5

Doubly reinforced Beam

Aim : To draw simple 2D diagram representing the cross section of beam and slab for the given data.

Data : Draw the L/S and C/S of a doubly reinforced beam for a building having following details

- Clear span length = 5000 mm
- Bearing thickness = 300 mm
- Overall depth of the beam = 650 mm
- Breadth of the beam = 300 mm
- Main reinforcement of beam (top) = #4-16mm dia bars
- Main reinforcement of beam (bottom) = #4-20mm dia bars
- Shear reinforcement of steel = 8mm dia bars @ 300mm c/c spacing

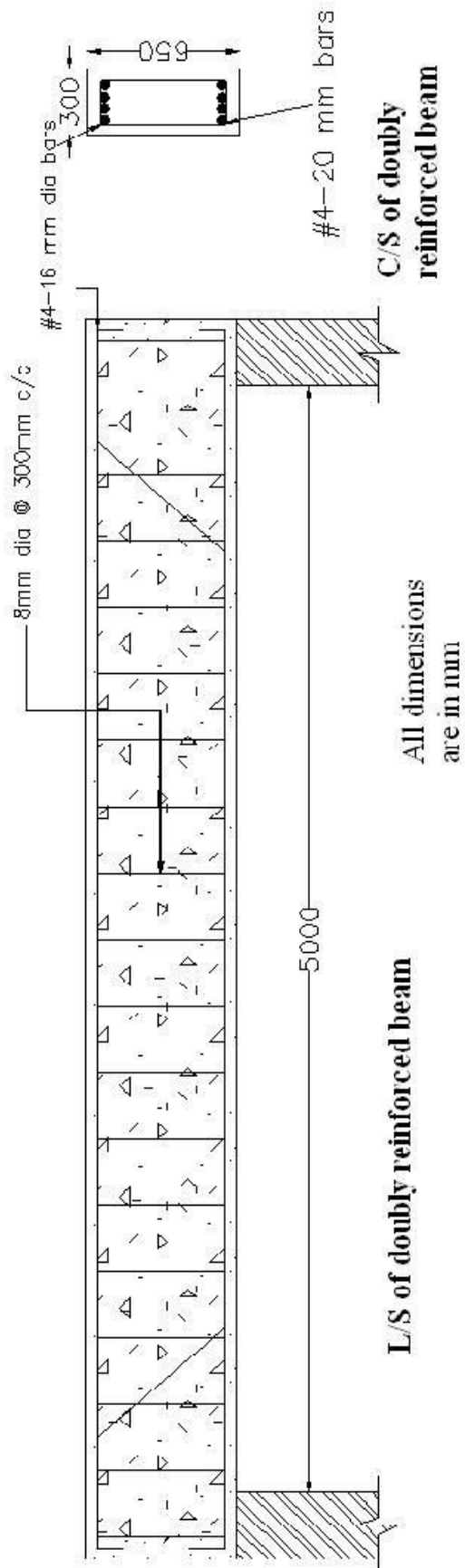
Software used: AUTOCAD

Commands used: Limits, ortho, offset, line, zoom, array, donut, move, trim, extend, hatch, dimension, text etc.

Procedure:

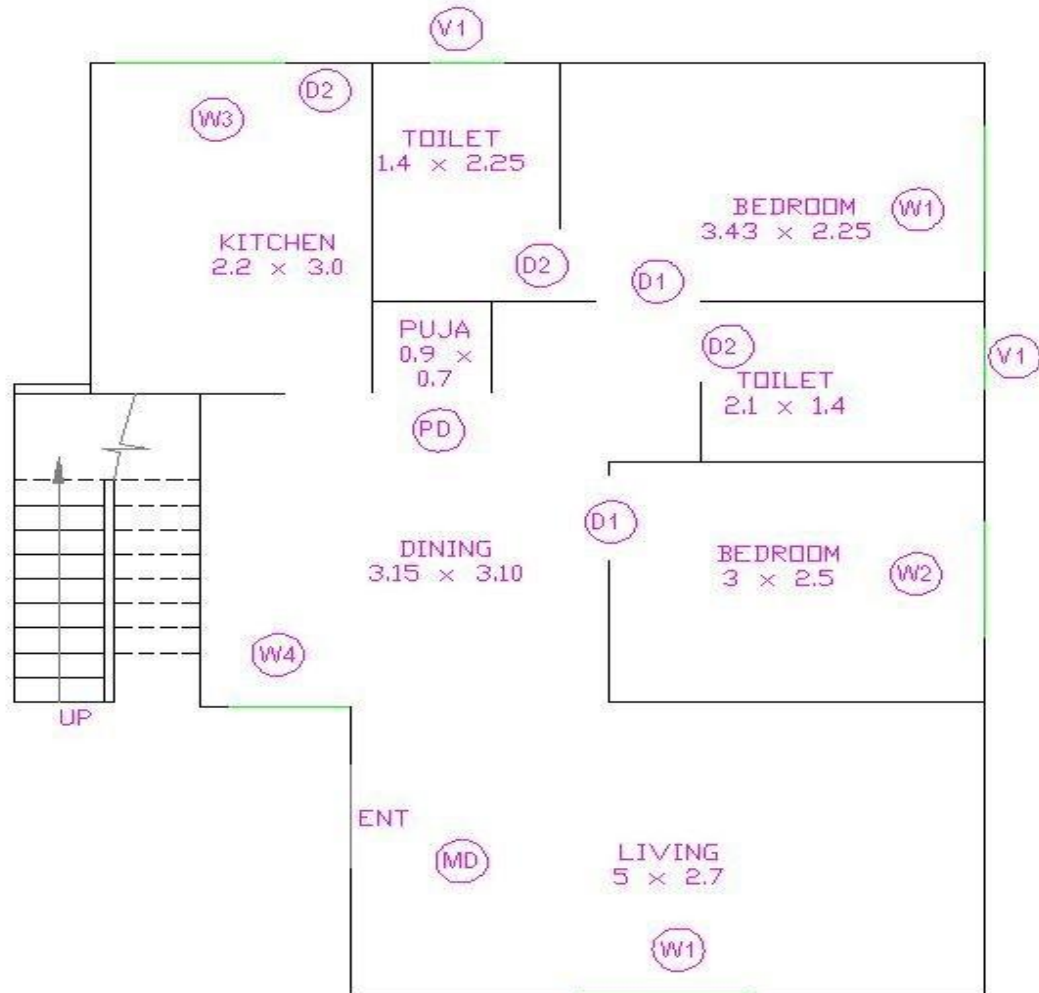
- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimetres.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labelling the drawing.

Result: The required C/S of beam and slab is drafted using the software.



Experiment No. 6 Residential Building

Aim : To draw the Plan, Cross section and elevation of a single storied residential building for the given line diagram.



Where,

MD – 1.1m x 2.1m	W1- 1.5m x 1.35m
D1 – 0.9m x 2.1m	W2- 1.2m x 1.35m
D2 – 0.75m x 2.1m	W3- 1.45m x 1.00m
PD – 0.90m x 2.1m	W4- 1.05m x 1.35m
V1 – 0.60m x 0.60m	W5- 2.20m x 1.35m

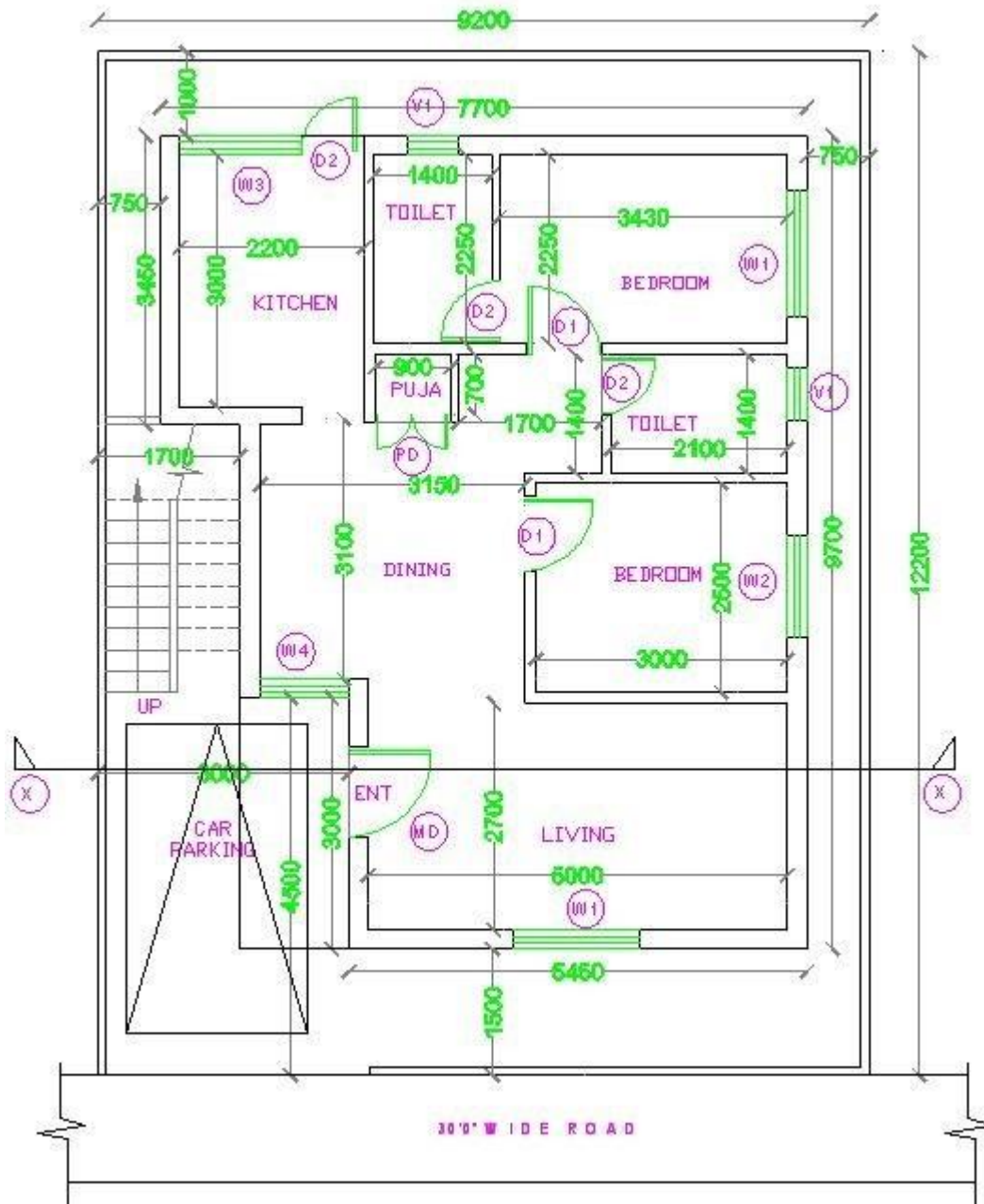
Software used: AUTOCAD

Commands used: Limits, ortho, offset, line, zoom, move, trim, extend, hatch, dimension, text etc.

Procedure:

- The limits are set before starting the drawing. The lower left corner is set as default (0.0000, 0.0000). The upper right corner is changed as per our requirements.
- By using units command, we set the types as decimal, precision as 0.0000 and units to scale as millimetres.
- Ortho is switched off as the drawing requires use of inclined line also along with horizontal and vertical lines.
- By using the line command, the outline of the required drawing is drawn.
- By using the trim command, the extra lines are trimmed.
- Lines are extended using extend command wherever necessary.
- Donut option is used to represent the c/s of reinforcements.
- Offset command is used to get lines at regular distance.
- Hatching is done using hatch command.
- Dimensions are provided and text command is also used for labelling the drawing.

Result: The required Plan, Cross section and elevation of a single storied residential building for the given line diagram is drawn using the software.

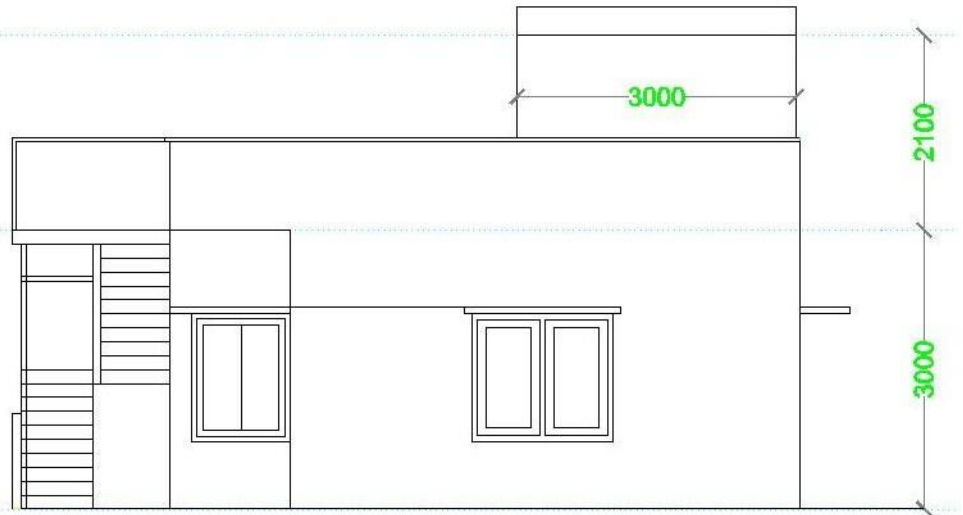


PLAN

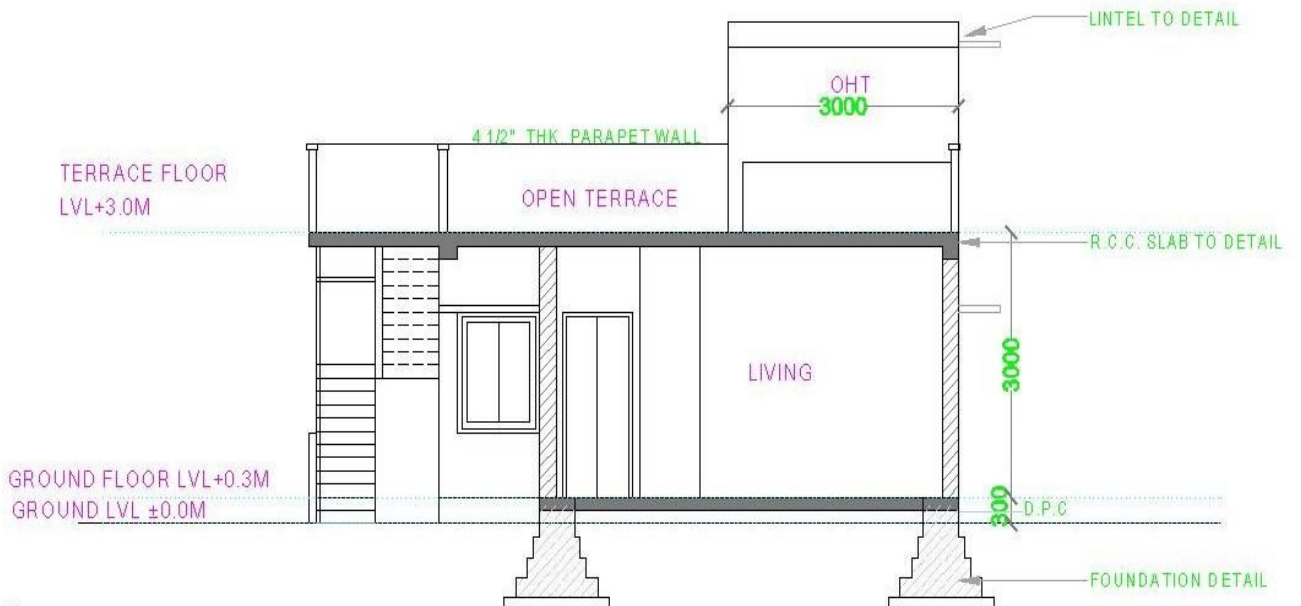
OHT TOP LVL+5.0M

TERRACE FLOOR
LVL+3.0M

GROUND LVL ±0.0M



ELEVATION



✓

SECTION