



Ahsanullah University of Science and Technology
Department of Electrical and Electronic Engineering

LABORATORY MANUAL FOR
ELECTRICAL AND ELECTRONIC SESSIONAL COURSES

Course No. : EEE - 3100

Course Title : Electrical Service Design Lab

For the students of

Department of Electrical and Electronic Engineering
3rd Year, 1st Semester

Experiment No.: 01

Experiment Name: Introduction to AutoCAD

Objective:

- To become familiar with the 2D drawing interface of AutoCAD 2007.
- To learn about Format Tools before drawing.

Theory:

AutoCAD is a professional computer aided design (CAD) and drafting software application, developed and marketed by Autodesk. It is used commercially across a wide range of industries by different professionals like architects, graphic designers, project managers and engineers. With the help of AutoCAD, the time required for design drafting can be reduced significantly compared to hand drawing and any revision in the drawing can be done quickly without having to redraw the entire design. 2D and 3D structures can be drawn using this software. There are many other software programs for electrical engineers to design electrical lines and systems. However, those software programs are not efficient and professional like AutoCAD. With AutoCAD, highly precise measurements can be ensured for drawing.

Procedure:

Step 1. Installing the software:

- Run “AutoCAD2007.part01.exe” as administrator.
- Select directory to install.
- Use the following serial: 111-11111111.
- Copy the .dll files into AutoCAD directory and overwrite old ones.
- Delete the “AutoCAD Temp” folder from the directory where installed.

Step 2. Opening the software:

- From the desktop of your computer, open the AutoCAD 2007 application
- Select “AutoCAD Classic” and click “Ok”.
- In the “New Features Workshop” window, select “do not show again” “Ok”.
- Two additional separate windows, Tool Palettes and Sheet Set Manager, will open. Click on the black cross to close these windows.
- Make sure that the drawing is in .dwg format (written with the file name).

Step 3. 2D User Interface:

Fig 1.1 shows the default screen after opening the software. The following tools can be observed which will be mostly used:

Drop-down Menu Bar: All options of AutoCAD can be accessed from this toolbar.

Draw Toolbar: All tools that are required for drawing such as line, circle, arc, rectangle, etc. can be found here.

Modify Toolbar: Tools such as copy, move, stretch, reflect, rotate, etc. that are required to modify a drawn segment can be found in this toolbar.

Command Bar: This bar shows the activated command. It can also be used to select a tool by typing its shortcut command.

Line Properties Toolbar: This toolbar can be accessed to change the color, line-type and line-weight of a drawing tool.

Drafting Settings and Status Bar: Supplementary settings used for easy drawing. Details will be discussed in next experiment.

- The background color of the drawing is in black by default. The color can be changed in the following way:

Right click on the screen Options Display Tab Colors.

- Change between 3D and 2D drawing:

Tools Workspace select between “3D Modeling” and “AutoCAD Classic”.

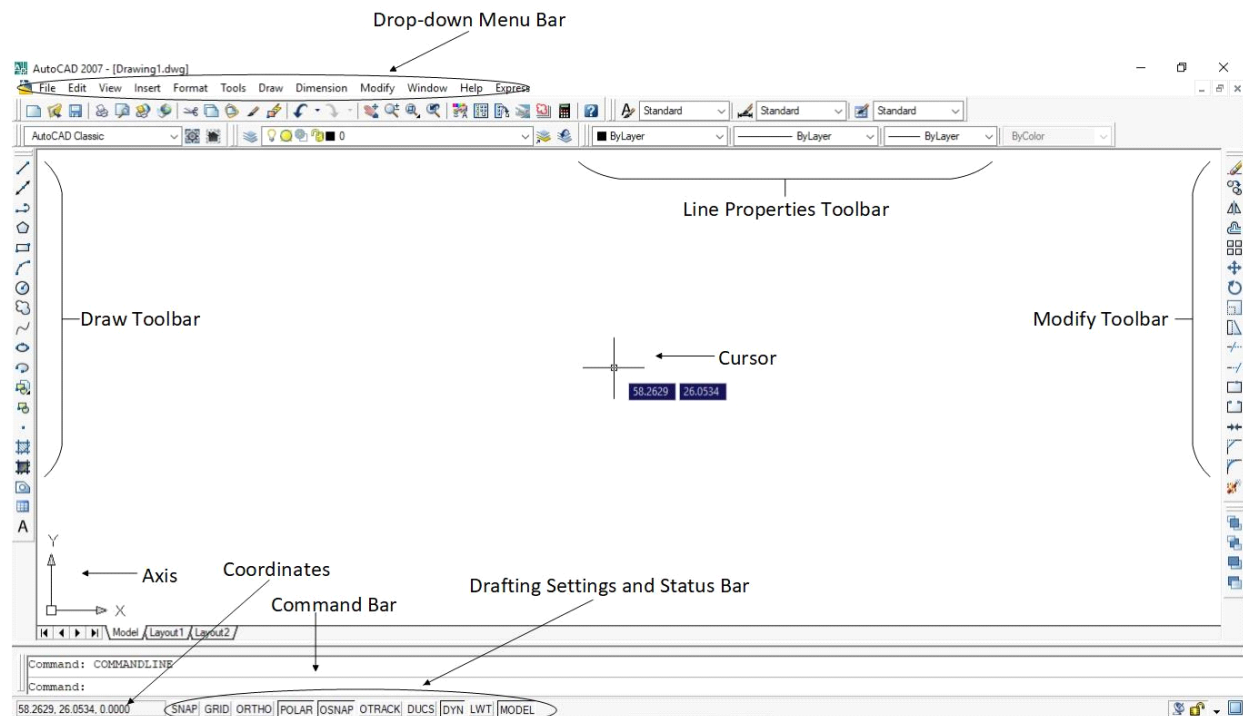


Fig. 1.1: 2D User Interface

Step 4. Format Tools:

Before starting to draw in AutoCAD, certain features must be setup at first according to the requirements of the drawing in terms of measurement and style. These features can be accessed from “Format” in the Drop-down Menu Bar.

Units:

- Go to the Units tool from Format Units or type “un” in the command line and press “Enter”.
- The “Drawing Units” dialogue box will open as shown in Fig. 1.2.

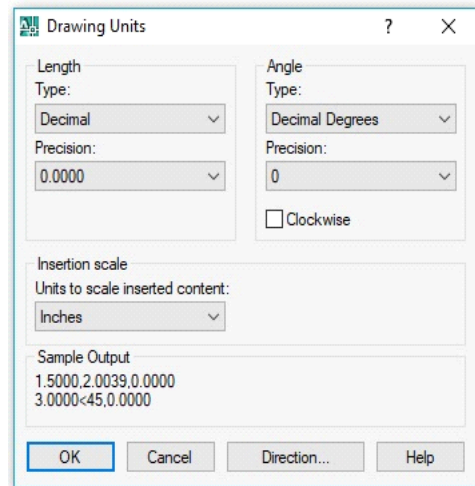


Fig. 1.2: Drawing Units

- Select the unit, type and precision of the length and angle measurements that will be used in your drawing.
- AutoCAD allows you to control the direction in which angular units are measured and the position of the start angle. AutoCAD starts with the zero angle at the 3 o'clock position (East) with angles increasing in an anti-clockwise direction. The zero angle position can be changed by going to “Directions” and selecting the Base angle. Check the “Clockwise” box if you want angles to be measured in the clockwise direction.

Dimensions:

- Go to Format Dimension Style or type “d” in command line and press “Enter”. The “Dimension Style” dialogue box will appear as shown in Fig. 1.3.
- The preview section shows how dimensions in your drawing will be displayed. You can alter the style and position of the line, arrow and text according to your choice. Select “Modify” and go the “Modify Dimension Style: Standard” dialogue box, which modifies the standard style.
- Extension lines and arrow lines can be changed from the “Lines” tab.
- To change line-type, click the drop-down arrow on “Linetype” and select “Other”. Select “Load” to choose between different line-types such as ‘dot’, ‘divide’, ‘dashed’, etc.

- Type of arrows can be selected from “Symbols and Arrows” tab.
- Text style of the measurement labels can be changed from “Text” tab.
- Select OK Close to exit.

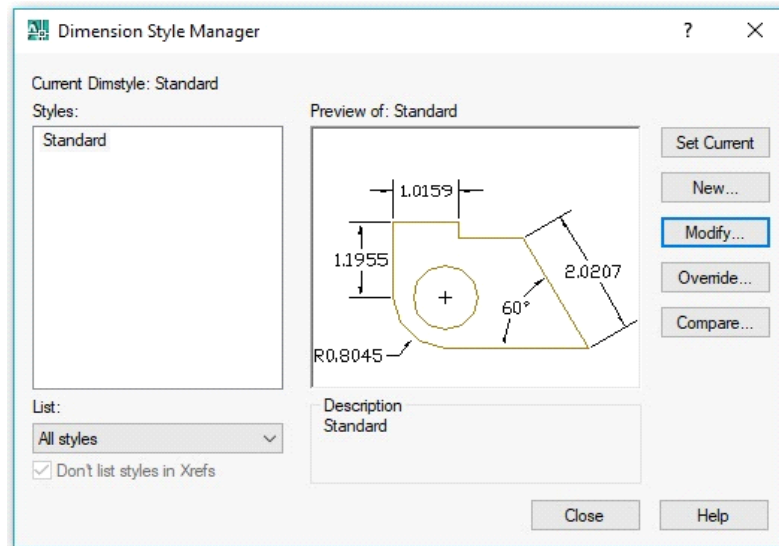


Fig. 1.3: Dimension Style

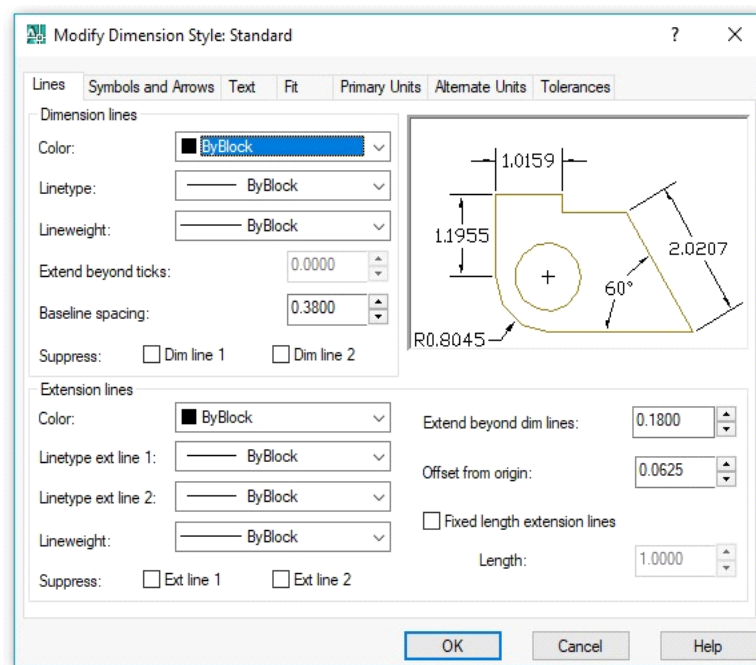


Fig. 1.4: Dimension Modify

Text Style:

- Go to Format Text Style. The “Text Style” dialogue box will appear as shown in Fig. 1.5.

- Select the style such as font name, type and size of texts that you will write on the drawing. A preview section is available for verifying the desired style is chosen.
- Click “Apply” and then “Close” to exit when done.

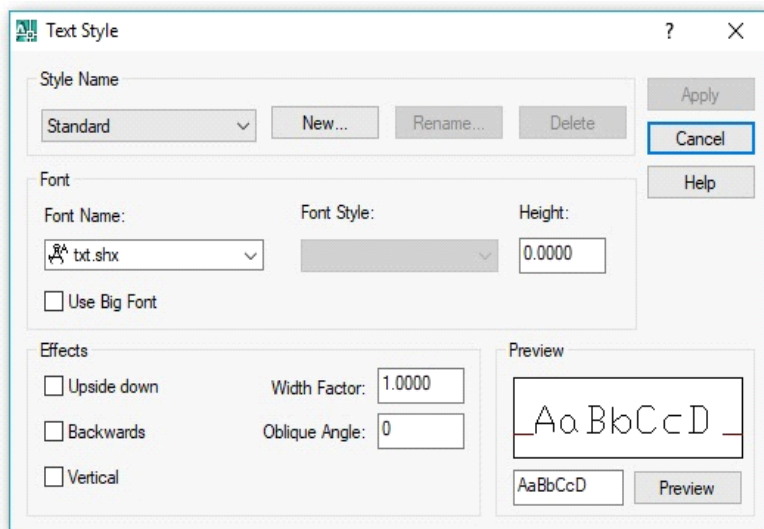


Fig. 1.5: Text Style

Table Style:

- Go to Format Table Style Modify to open the “Modify Table Style” dialogue box as shown in Fig. 1.6.

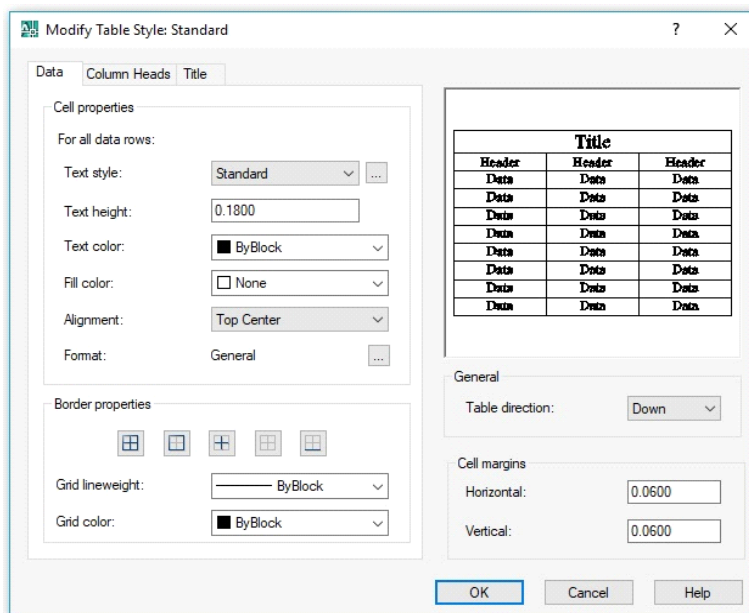


Fig. 1.6: Modify Table Style

- Select table properties like text size, text style, text color, table border, cell size, table title, alignment, etc.
- Table is used to create legends of the drawing.

- Text Style, Dimension Style and Table Style can be quickly accessed from above the Line Properties Toolbar.
- Text Style and Table Style are usually changed dynamically whenever required.

How to save a file:

- Click “File” from drop down menu bar and select “Save as” OR press “Ctrl+S”.
- Select drive to save.
- Rename file name only (keep .dwg as extension).
- Select “Save”.

How to plot a file (save drawing as pdf):

- Click “File” from drop down menu bar and select “Plot” OR press “Ctrl+P”.
- In the Printer/plotter section, select “DWG to PDF.pc3” in “Name”.
- Select desired paper size.
- Check “Fit to paper” and “Center to plot”.
- Select “Window” from “Plot area” and select the area in the drawing you want to plot.
- Click “Preview” to observe the drawing to be plotted.
- Press “Esc” to exit preview.
- Select “Ok” to confirm and save at a desired location.

Important control keys:

- Ctrl+A = select all
- Ctrl+N = opens dialogue box to create new drawing
- Esc = cancel command
- Ctrl+Z = undo
- Ctrl+Y = redo
- Ctrl+S = open save dialogue box
- Ctrl+P = open plot dialogue box
- F1 = help

Report:

1. What are the advantages of using AutoCAD ?
2. Make an excel table of some shortcut tools of AutoCAD.

Experiment No.: 02

Experiment Name: Familiarization with Drafting Settings and Drawing with AutoCAD Tools

Objective:

- Learn all kinds of settings and tools required to draw in AutoCAD.
- Learn to draw different shapes using those tools.

Procedure:

Various Drafting Settings:

GRID:

- Click on “GRID” tab or press F7 to enable/disable grid points on the drawing window.

If grid points are not visible after selection, right click on the “GRID” tab and select “Settings”. The “Drafting Settings” window will open. On the “Snap and Grid” tab, check the “Display grid beyond Limits” box. Grid spacing can also be set from this window.

POLAR and ORTHO:

The POLAR and ORTHO tabs can be selected alternatively. Press F8 for ORTHO or F10 for POLAR.

a) ORTHO:

In ORTHO mode, only horizontal or vertical lines can be drawn.

b) POLAR:

In POLAR mode, lines can be drawn freely at any angle. While drawing the line, you can track angles after a fixed increment of 90° (by default) or any other given values. You can also track other specific angles of your choice for convenience in drawing.

- Right-click on “POLAR” tab and choose “Settings” to open the “Polar Tracking” tab in Drafting Settings. You can change increment angle from drop down menu to change the tracking angle. To track additional specific angles, check “Additional angles” box. Select “New”, type your angle and press “Enter”. Click “OK” to exit.
- You can change from POLAR mode to ORTHO mode temporarily by holding down “Shift”.

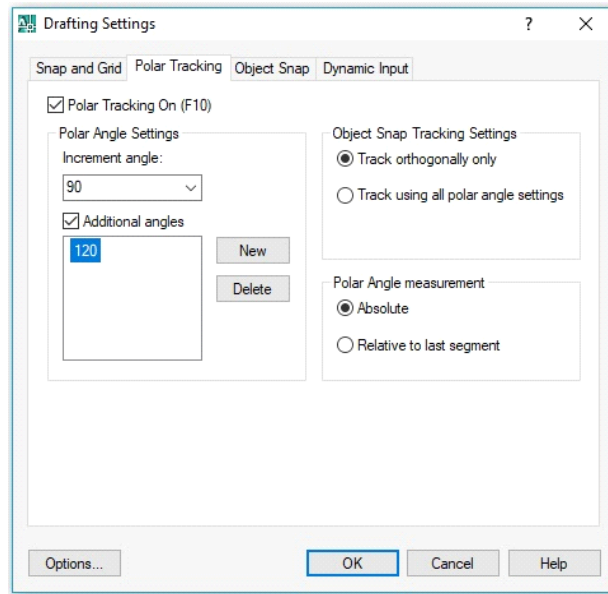


Fig. 2.1: Polar Tracking

OSNAP:

- Right-click on OSNAP tab and choose “Settings” to open the “Object Snap” tab in Drafting Settings.

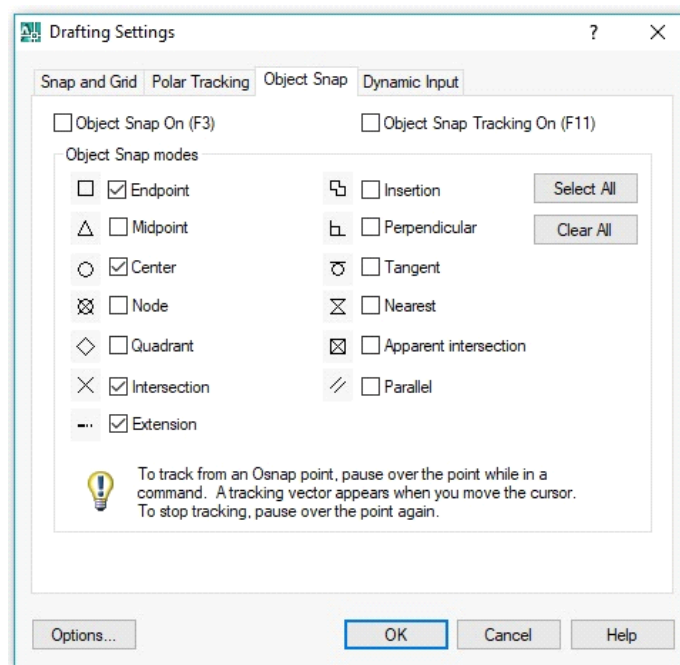


Fig. 2.2: Object Snap

Here you can select the points that will be indicated in a drawn line by AutoCAD to help you connect other lines to it. If all options are deselected, no points will be indicated and user will have to use their visible capability to identify the endpoints, center points, intersections, etc.

- Click “OSNAP” or press F3 to enable/disable OSNAP mode.

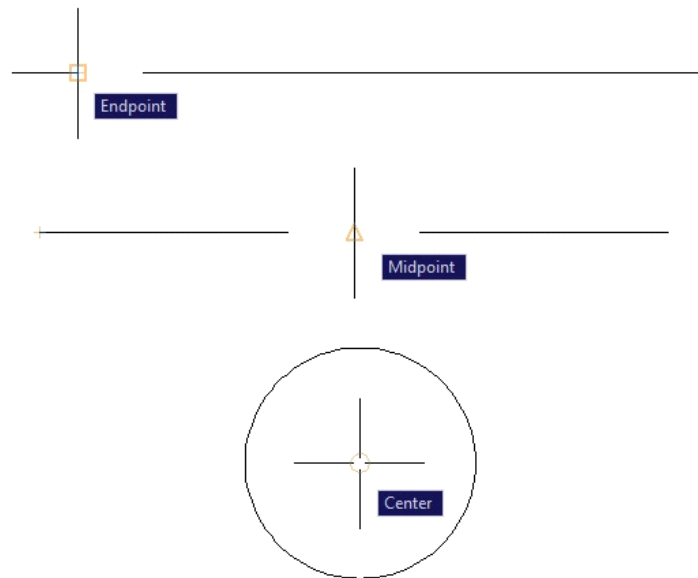


Fig. 2.3: Examples of OSNAP modes

Dynamic Input:

- Right-click on “DYN” tab and go to “Settings”.

a) Pointer Input:

Pointer Input shows the positional coordinates of the pointer on the screen. You can enter coordinate values on the tooltip instead of on the command lines.

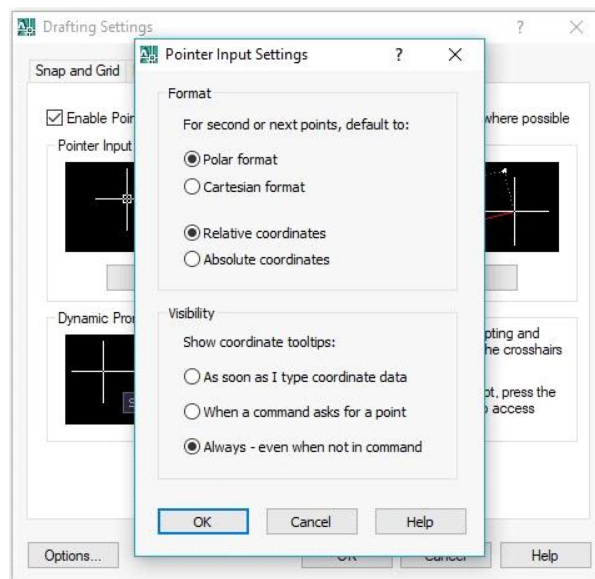


Fig. 2.4: Pointer Input Settings

- Select “Enable Pointer Input” and go to “Settings” of Pointer Input.
- Choose whether to show coordinates in polar format or Cartesian format.
- Select “Relative coordinates”.
- Under “Visibility”, select “Always – even when not in command”. This shows the pointer position even when no drawing tool is selected.

b) Dimension Input:

Displays a dimension with tooltips for distance value and angle value when a command prompts for a second point or distance. The values in the dimension tooltips change as you move the cursor. You can enter values in the tooltips instead of in the command line.

- Select “Enable Dimension Input where possible”.

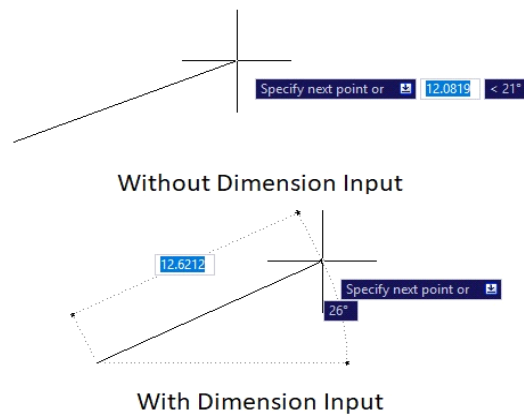


Fig. 2.5: Dimension Input

- Click on “DYN” tab or press F12 to enable/disable Dynamic Input settings.
- When Pointer Input and Dimensional Input are both turned on, the latter supersedes the first when it is available.

Line Weight:

- Click “LWT” to show or hide line thickness.
- If line thickness is not shown, right-click on LWT and go to “Settings”. Select “Display Line weight”. Other line weight settings can also be set from this window.

Line Properties:

Color, line type and thickness of lines to be drawn can be selected from the Line Properties toolbar.

- Click drop down arrow of “Color control” to choose the color of the line.

- Click drop down arrow of “Linetype control” and select “Other”. Select “Load” and choose the type of line that you desire. Select “Ok” twice to exit. Now click the drop down arrow again and select the new chosen line. Now you can draw the line you chose.
- Click the drop down arrow of “Lineweight Control” to select the thickness of the line. This can also be selected from the “LWT” settings.

Draw Toolbar:

This toolbar contains all tools required to draw shapes in your drawing. The tools can be selected in one of the three ways:

- Select the tool from “Draw” in the drop down menu bar on the top.
- Click on the desired tool icon from the Draw Toolbar on the left.
- Type the shortcut command in the command line and press “Enter”.

➤ **Line (l)**

- By picking two points:
 - Click at any point to select the starting point.
 - Click at any other point to select the end point.
 - Press “Esc” to exit.
- By direct distance entry:
 - Specify first point by clicking at any point.
 - Type length of the line.
 - Press “Tab”.
 - Type angle of the line with the x-axis.
 - Press “Enter”.

➤ **Rectangle (rec)**

- By picking two corner points:
 - Click at any point to specify first corner point.
 - Click again at any other point to specify second corner point.
- By direct length entry:
 - Specify first corner point (click at any point).

- Input length along X (type length of the rectangle).
- Press “Tab”.
- Input width along Y (type width of the rectangle).
- Press “Enter”.

➤ Circle (c)

- By radius entry:
 - Specify center point (click at any point). You can also specify center point by x and y coordinate inputs: type x coordinate, press comma, type y coordinate, press “Enter”.
 - Input radius of the circle (type radius of the circle or click at a desired point).
 - Press “Enter”.
- By diameter entry:
 - Specify center point.
 - Type “d”.
 - Press “Enter”.
 - Input diameter of the circle (type diameter of the circle or click at a desired point).
 - Press “Enter”.

➤ Arc (a)

To draw an arc three points on the arc are necessary. The choice of these points depends on the user or availability of defined points. AutoCAD by default draw arc anticlockwise. So select start and end points properly to get the desired arc shape.

- Select the Arc tool and follow the steps for one of the options in Table 2.1 to draw an arc.

Table 2.1: Available options to draw an arc and its steps.

<i>Available options</i>	<i>Steps</i>
Center, Start, End	<ul style="list-style-type: none"> • Type c • Press “Enter” on the keyboard • Specify center point of the arc (Click at the center point of the desired arc)

	<ul style="list-style-type: none"> Specify start point of the arc (Click at the start point of the desired arc) Specify end point of the arc (Click at the end point of the desired arc)
Start, Center, End	<ul style="list-style-type: none"> Specify start point of the arc (Click at the start point of the desired arc) Type c Press “Enter” on the keyboard Specify center point of the arc (Click at the center point of the desired arc) Specify end point of the arc (Click at the end point of the desired arc)
Start, Center, Angle	<ul style="list-style-type: none"> Specify start point of the arc (Click at the start point of the desired arc) Type c Press “Enter” on the keyboard Specify center point of the arc (Click at the center point of the desired arc) Input angle (Angle of end point with X axis at center)
Start, End, Radius	<ul style="list-style-type: none"> Specify start point of the arc (Click at the start point of the desired arc) Type e Press “Enter” on the keyboard Specify end point of the arc (Click at the center point of the desired arc) Type r Press “Enter” on the keyboard Input radius (type radius of the desired arc)

➤ **Polygon (pol)**

- Input number of sides
- Specify center point (click at any point or type x and y coordinates).
- Select an option

- Inscribed in circle
- Circumscribed about circle
- Input radius of circle (type radius of circle or click at a desired point).
- Press “Enter”.

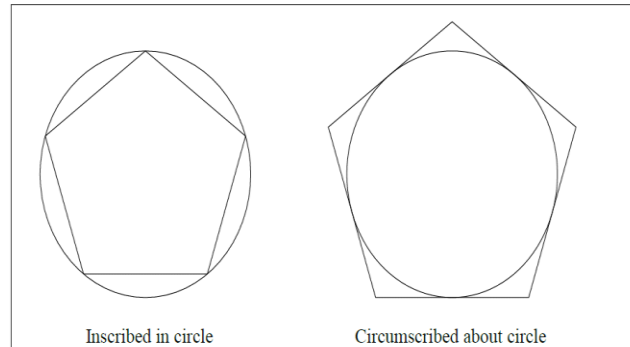


Fig. 2.6: Polygon with circle

➤ **Ellipse (el)**

- Specify first point of major axis (click at any point or input x and y coordinates).
- Specify second point of major axis (click at any point or input length across desired direction and press “Enter”).
- Specify minor length (click at any point or input distance from midpoint of major axis to endpoint of minor axis).

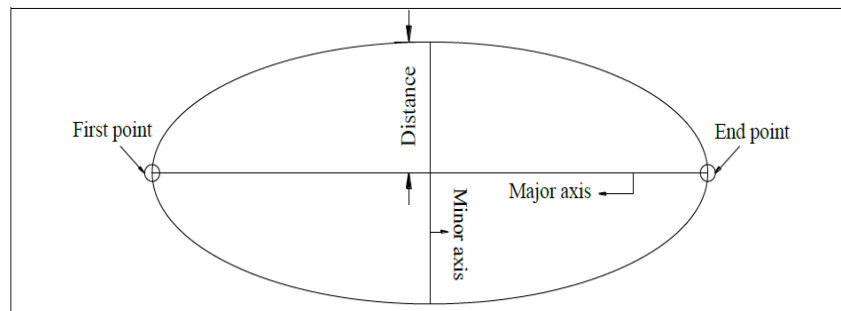


Fig. 2.7: Ellipse structure

Report :

1. Why ‘ORTHO’ and ‘OSNAP’ are required?
2. Draw a circle having radius 5cm which is inside an ellipse having major axis is 20 cm and minor axis is 10cm so that both of them have a same center.

Experiment No.: 03

Experiment Name: Familiarization with Various types of Drawing Tools and Modify Tools

Objective:

- Learn to apply patterns using Hatch tool.
- Learn to include texts in drawing.
- Learn to modify shapes using Modify tools.

Procedure:

Various types of Drawing Tools :

➤ **Hatch (h)**

- To apply patterns in desired area.
- Use predefined type.
- Choose the desired pattern by clicking the “...” icon in “Pattern”.
- Choose angle from default options. The angle changes the orientation of the pattern.
- Choose scale value from default options. Larger scale value lightens the hatch while lower value makes the hatch lines denser.

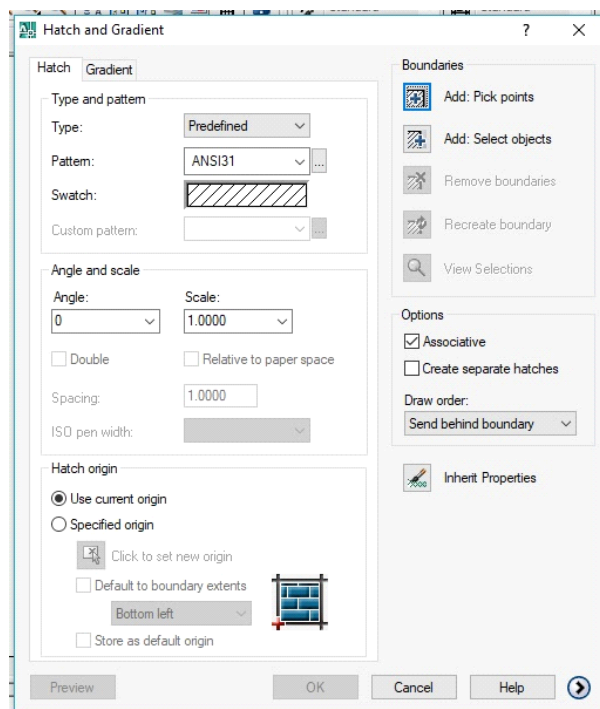


Fig. 3.1: Hatch properties

- Choose appropriate boundary selection option:
 - “Add: pick points”: Click at any point in an enclosed area in the drawing.
 - “Add: select objects”: Select objects between which pattern will be created (objects may or may not create enclosed area).
- Press “Enter”.
- Choose Options:
 - Check “Associative” option to allow modification of hatch shape with the boundary shape.
 - Check “Create separate hatches” option to create separate hatches in case of multiple boundary selection.
- Click “Preview” to observe hatch created.
- Press “Enter” if desired hatch is obtained or “Esc” to go back to the settings window.

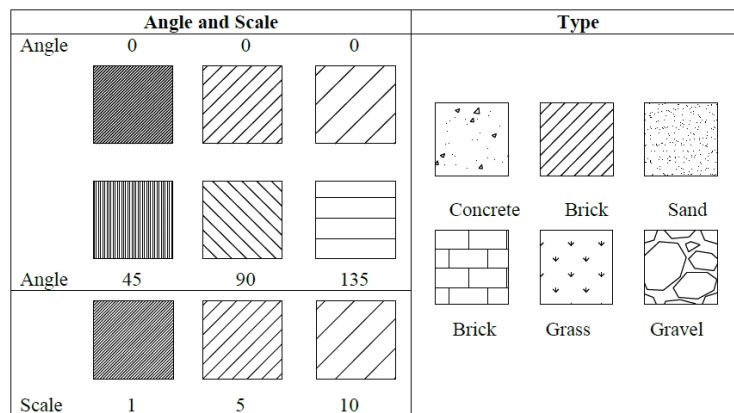


Fig. 3.2: Hatch examples

➤ **Text (t)**

- Draw small window.
- Select text style and font (if necessary).
- Type text height.
- Write on the shaded box.
- Press “Enter” on the keyboard to go to the next line (if necessary).
- Click “Ok”.
- To edit a written text, double click on the text to open the editor toolbar. Select the whole text and edit as required.
- Click @ icon to insert symbols.
- Fraction, subscript or superscript can be inserted according to the steps shown in Table 2.2.

Table 2.2: Instructions for writing fraction, subscript and superscript.

	Steps	Output
Superscript	<ul style="list-style-type: none"> • Type X2^ • Select 2^ • Click “stack” icon 	X^2
Subscript	<ul style="list-style-type: none"> • Type X^2 • Select ^2 • Click “stack” icon 	X_2
Fraction	<ul style="list-style-type: none"> • Type X/Y • Select X/Y • Click “stack” icon 	

Modify Toolbar:

This toolbar contains all tools required to modify/edit drawn shapes. This includes copy, stretch, rotate, flip, trim, etc. The tools can be selected in one of the three ways:

- Select the tool from “Modify” in the drop down menu bar on the top.
- Click on the desired tool icon from the Modify Toolbar on the right.
- Type the shortcut command in the command line and press “Enter”.

Copy (co or cp)

- Select object.
- Press “Enter”.
- Specify the base point (recommended to click at the center of the object). Object is copied on the cursor and moves with respect to the base point.
- Specify the position where the object will be copied: click at any point or input location in polar/Cartesian format.

Move (m)

- Select object.
- Press “Enter”.
- Specify the base point.
- Specify the position the object is to be moved.

Rotate (ro)

- Select object.
- Press “Enter”.
- Specify the base/center point with respect to which the object will be rotated.
- Type angle with respect to x-axis. AutoCAD takes positive angle in anticlockwise direction by default. To rotate clockwise, type negative value for angle.

Mirror (mi)

- Select object.
- Press “Enter”.
- Click at any point to specify first point of mirror line.
- Click at another point to specify second point of mirror line.
- Type “y” to erase source object or “n” to keep source object.
- Press “Enter”.

Offset (o)

This tool is used to draw another parallel line at fixed distance from source line.

- Input offset distance (perpendicular distance between parallel lines).
- Press “Enter”.
- Select object (only one line can be selected).
- Click at any one side of the line to specify on which side you want the parallel line.

Array (ar)

Creates an array of an object at either rectangular arrangement or polar arrangement.

- Rectangular Array:
- Input number of rows and columns.
- Input row offset and column offset. Offset distance is the center to center distance between adjacent objects in each row and column.
- Input angle of array if necessary (angle of row with x-axis).
- Click “Select objects” and select object in drawing.
- Press “Enter”.
- Click “Preview” to observe the array to be created.
- Click “Accept” if desired array is obtained or “Modify” to further modify settings.

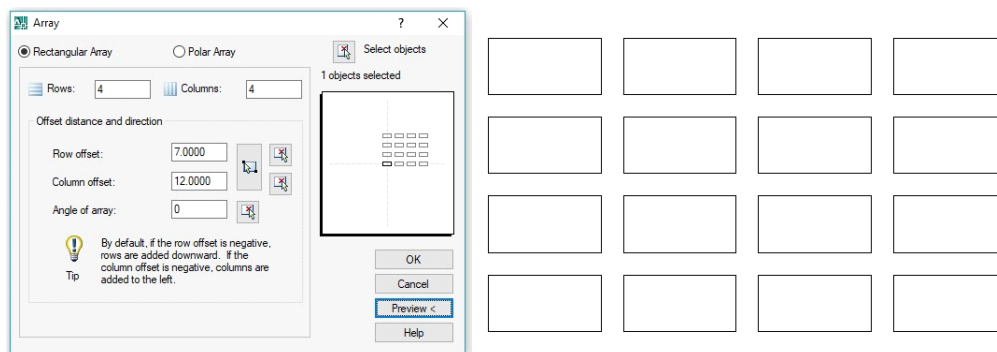


Fig. 3.3: Rectangular Array

Polar Array (radial):

- Specify center point by typing x and y coordinates.
- Choose appropriate method to input any two of the following values:
- Total number of items: total number of copied objects in the array.

- Angle between items: angle from center between two adjacent copied objects.
- Angle to fill: total angle of the array to be filled up by the array elements.
- Check/uncheck “Rotate items as copied” to choose whether to rotate the elements as they are copied and placed in the array.
- Click “Select objects” and select the object.
- Press “Enter”.
- Click “Preview” to observe the array to be created.
- Click “Accept” if desired array is obtained or “Modify” to further modify settings.

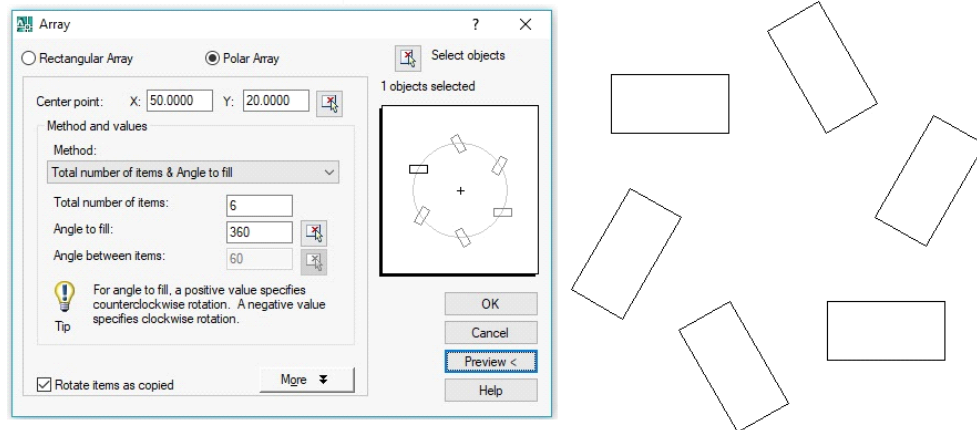


Fig. 3.4: Polar Array settings

Scale (sc)

- Select object.
- Press “Enter”.
- Specify the base point (point with respect to which the object will be resized).
- Type scale factor (greater than 1 to enlarge and less than 1 to shrink proportionally).
- Press “Enter”.

Trim (tr)

- Right-click to select all lines.
- Select section of lines (that intersect another line) to trim.

Extend (ex)

- Right click to select all lines.
- Select end of a line which can be extended until it connects with another line.
- Hold “Shift” key to alter between Trim and Extend commands.

Break at Point

This tool breaks a line or object at a point to divide it into two segments so that they can be individually selected.

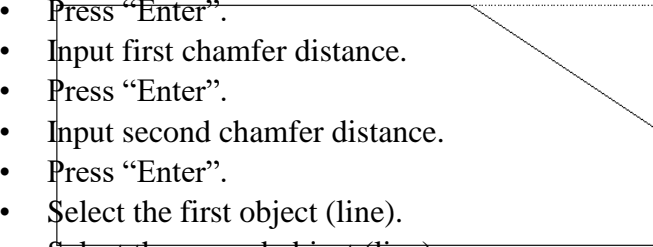
- **Break**

This tool can be used to cut a segment of the line in the middle.

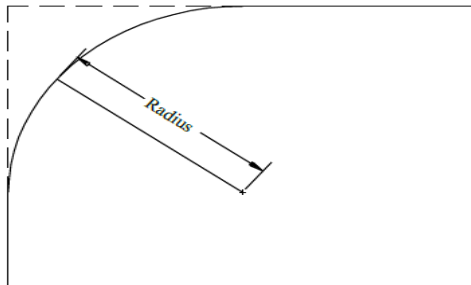
- Click at a point in line to select first cutting point.
- Click at another point to select second cutting point.

The line is cut between the first and second points.

- **Chamfer (cha)**
- Type “d” to input distance first.
- Press “Enter”.
- Input first chamfer distance.
- Press “Enter”.
- Input second chamfer distance.
- Press “Enter”.
- Select the first object (line).
- Select the second object (line).



•



- **Fillet (f)**
- Type r to input radius first.
- Press “Enter”.
- Input radius.
- Press “Enter”.
- Select the first object (line).
- Select the second object (line).

Report :

1. Draw a ceiling fan applying mirror and polar array.
2. How offset can be used to simplify drawing ?

Experiment No.: 04

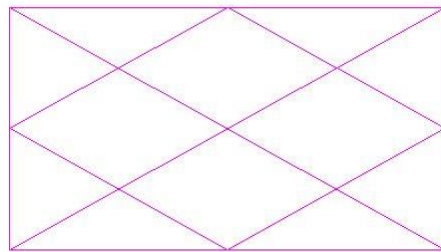
Experiment Name: Designing the symbols of Meter, MDB, DB, SB through AutoCAD

Objective:

- Draw simple symbols for meter, distribution boards and switch boards
- Draw basic load symbols

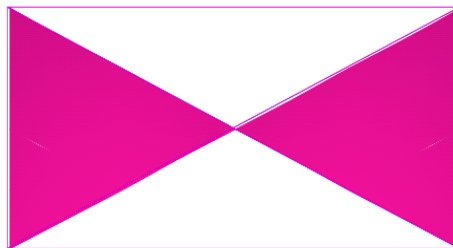
Symbol and Procedure:

ESB:



- Draw a rectangular of any size.
- Find out the mid points of the 4 arms of the rectangle.
- Draw a diamond with corners connecting the mid points.
- Draw the diagonals of the rectangle.
- Save the figure as ESB.dwg file.

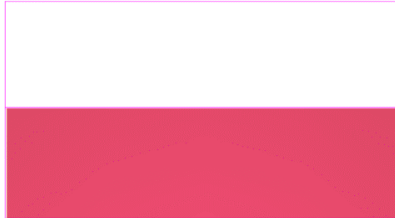
MDB:



- Draw a rectangular of any size.
- Draw two diagonals as shown in the diagram above.

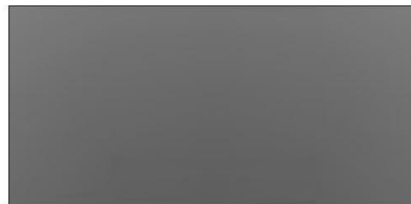
- Select “Gradient” from Draw Toolbar. Select “Add: pick points” and then select the left and right triangle. Choose a desired colour (eg. Magenta).
- Save the figure as MDB.dwg.

DB:



- Draw a rectangular of any size.
- Find out the mid points of left and right arms and connect them.
- Select “Gradient” from Draw Toolbar. Select “Add: pick points” and then select the lower rectangle. Choose a desired colour (eg. Magenta).
- Save the figure as DB.dwg.

SB:



- Draw a rectangle.
- Select “Gradient” from Draw Toolbar. Select “Add: pick points” and then select the rectangle. Choose a desired color.
- Save the figure as SB.dwg.

Report :

1. Draw METER, MDB, DB, SB, ESB and place them in a rectangular room.

Experiment No.: 05

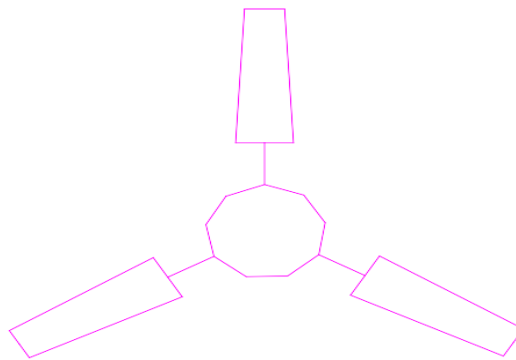
Experiment Name: Designing the symbols of Ceiling Fan, Wall Bracket Light, 5A/10A 2 Pin Socket and Tube Light through AutoCAD

Objective:

- Draw simple symbols for meter, distribution boards and switch boards
- Draw basic load symbols

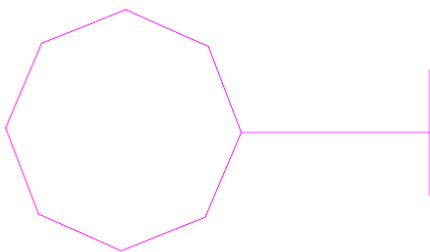
Symbol and Procedure:

Ceiling Fan:



- Draw a nanogon (9 corners).
- At one corner, draw 1 arm of fan.
- Copy the arm twice and rotate them 120 degree and 240 degree respectively.
- Connect the arms in such a way that 3 arms are connected with 3 corners of nanogon and they have angle difference 120 degree with each other.
- Save the figure as FAN.dwg.

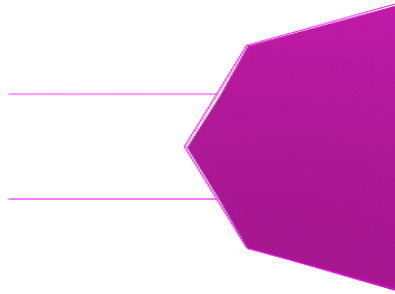
Wall Bracket Light:



- Draw an octagon. Rotate it in such a way that one of the corner is at 0 degree.

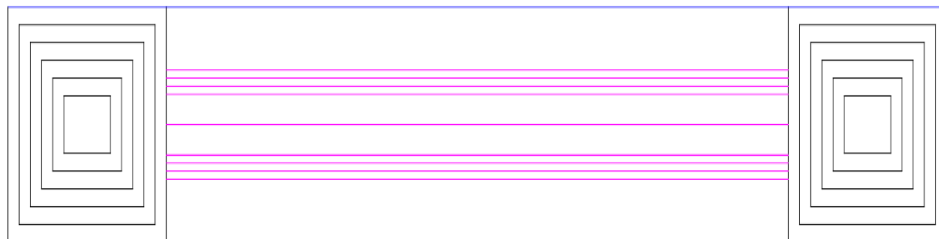
- Draw a straight line horizontally from the right corner of the octagon.
- Draw 1 vertical line and connect its midpoint with the rightmost point of the horizontal line.
- Save the figure as WBL.dwg.

5A/10A 2 Pin Socket:



- Draw an octagon. Rotate it in such a way that one of the corner is at 0 degree.
- Draw a straight line from the top point to bottom point of Octagon.
- Select the octagon, press “X” and then “Enter” to break the octagon into 8 straight lines.
- Delete the lines which are at the right side of the vertical line.
- Draw 2 equal horizontal straight lines from the midpoints of the middle two straight lines to the left side.
- Then select a desired colour (eg. Magenta) from Gradient.
- Save the figure as 2pinsocket.dwg.

Tube Light:



- Draw a rectangle.

- Press “o” to select offset and take a small distance. Then select the rectangle and press enter which will create a rectangle at the selected distance. Again select the new rectangle and press enter to create another rectangle at the same distance. In this way we draw 6 rectangles.
- Then select all the rectangles and press “m” to select mirror. Choose a horizontal distance of at least twice the arm of the largest rectangle. Turn ORTHO mode ON and horizontally mirror at the left or right side.
- Now draw 3 horizontal straight lines from the top, mid, and bottom points of the left arm of outermost rectangle of right side to the top, mid, and bottom points of the right arm of outermost rectangle of left side. Now draw 4 horizontal straight lines between top and middle horizontal lines. Select the 4 straight lines and vertically mirror them w.r.t. the middle straight line.
- Save the figure as TL.dwg.

Report :

1. Draw ceiling fan, wall bracket light, 2 pin socket, tube light and place them in a rectangular room.

Experiment No.: 06

Experiment Name: Design a flat using commercially available AutoCAD software.

Objective:

- Draw simple symbols for door and window.
- Draw a flat.

Symbol and Procedure:

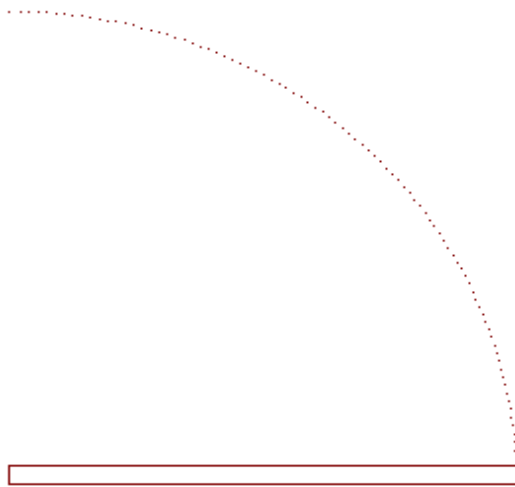


Fig. 6.1: 3'00" x 0'1.5" door

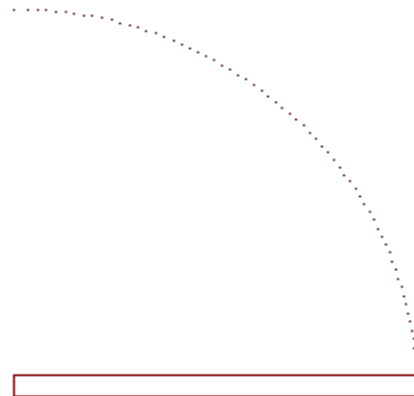


Fig. 6.2: 2'03" x 0'1.5" door

- Draw a rectangle of size 3'00" x 0'1.5".
- Draw an arc and change its linetype as shown in the Figure.6.1 and save as door1.dwg file.
- Similarly save door2.dwg file where the size of rectangle will be 2'03" x 0'1.5" as shown in Figure.6.2.



Fig. 6.3: 4'00" x 0'1.5" window



Fig. 6.4: 2'00"x0'1.5" window

- Similarly save window1.dwg and window2.dwg files where the areas will be 4'00"x0'1.5" and 2'00"x0'1.5" respectively. These are shown in Figure.6.3 and Figure.6.4.

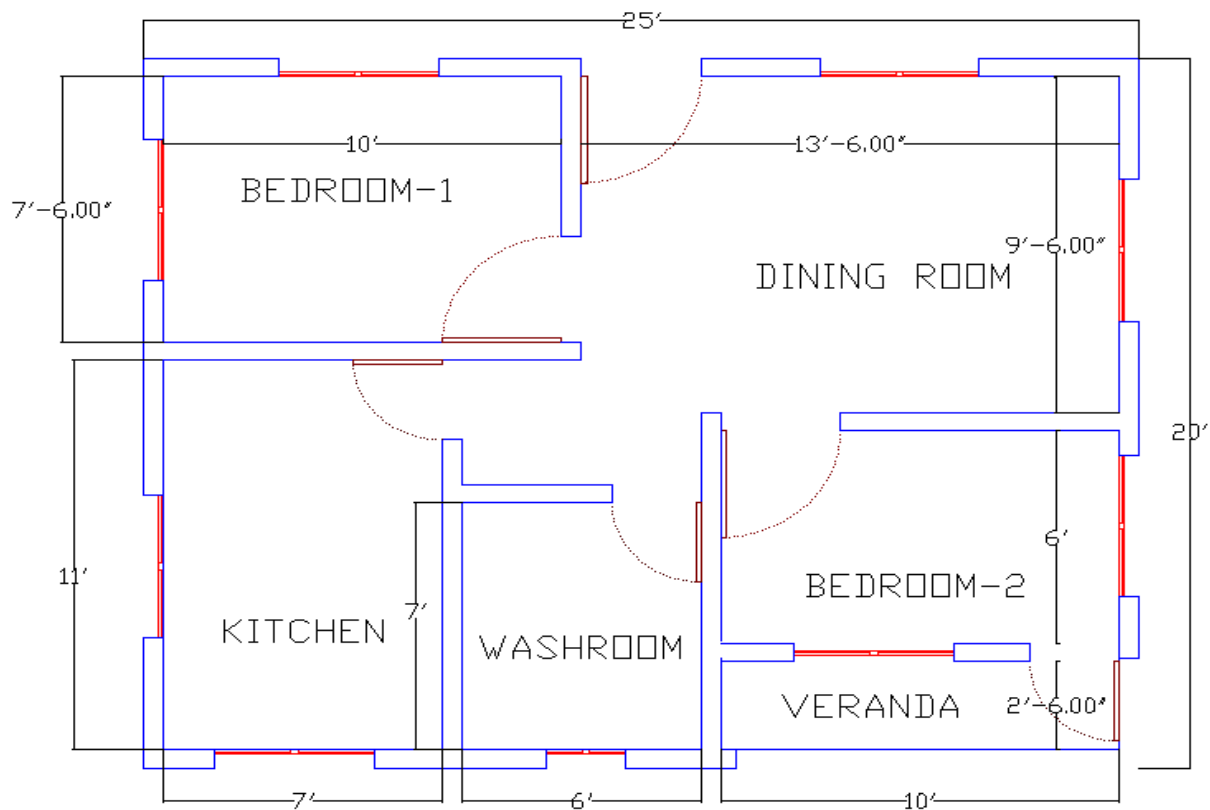


Fig. 6.5: 25'00"x20'00" flat

- Now draw a rectangle of 25'00"x20'00" in a new *.dwg file and save as flat.dwg.
- Take offset of 0'06" and draw another rectangle inside the previous one.
- Now draw 2 bedrooms, 1 dining room, 1 washroom, 1 kitchen and 1 veranda.
- Go to "Insert" tab and choose "DWG Reference". Insert door1.dwg and make 3 copies. Fit them in 2 bedrooms and 1 will be used as main door of the flat.

- Similarly insert door2.dwg and make 3 copies. Fit them in kitchen, washroom and veranda.
- Insert window1.dwg and make 8 copies. Put 2 windows in each of bedroom1, bedroom2, kitchen, and dining room as shown in Figure.6.5.
- Insert window2.dwg and put it in the washroom.
- Insert Multiline Text and write the rooms' names.
- Save the drawing.

Report :

1. Design a flat and place necessary electrical loads inside the flat.

Experiment No.: 07

Experiment Name: Inserting symbols in a flat using commercially available AutoCAD software.

Objective:

- Insert symbols drawn in experiment 4 & 5 in the flat designed in experiment 6.

Symbol and Procedure:

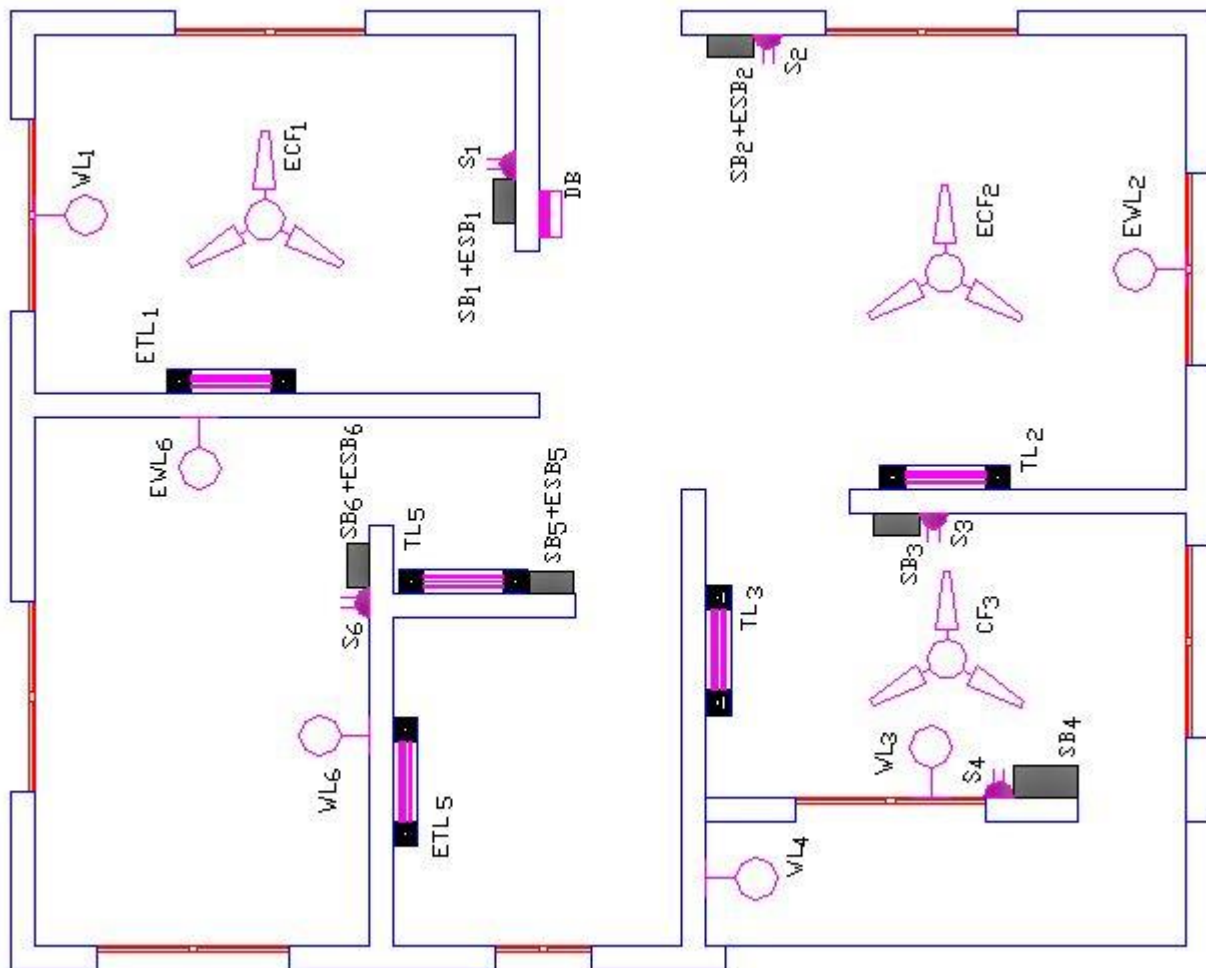


Fig. 7.1: Symbols inserted in the 25'00"x20'00" flat

- Insert FAN.dwg and make 4 copies. Put them in 2 bedrooms and dining room as shown in Figure.7.1.
- Insert TL.dwg and make 3 copies. Put them in 2 bedrooms and dining room as shown.
- Insert WBL.dwg and make 7 copies. Put them in all the rooms as shown.
- Insert SB.dwg and make 6 copies. Put them in all the rooms as shown.
- Insert 2pinsocket.dwg and make 5 copies. Put them beside SB in all the rooms except washroom.
- Place arcs between SBs and equipments to represent wires. For 1 wire from SB to equipment, Give the name C_1 . For 2 wires the name will be C_2 .
- Save the drawing.

Report :

2. Name SB, ESB, DB, S and all loads which are placed in experiment no. 6.

Experiment No.: 08

Experiment Name: Wiring of a flat using commercially available AutoCAD software.

Objective:

- Wiring the flat designed in experiment 6 where different symbols were inserted in experiment 7.

Symbol and Procedure:

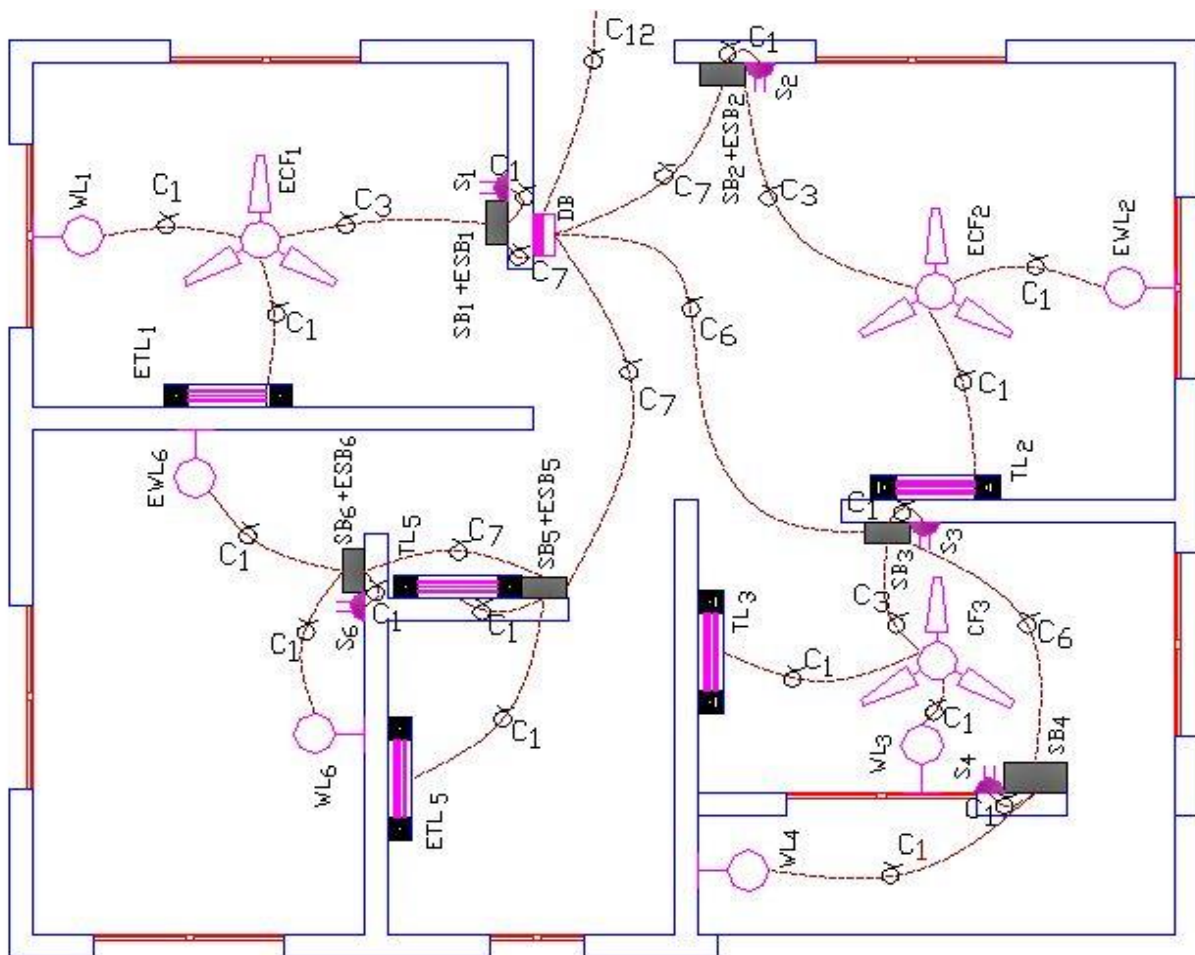


Fig. 8.1: Wiring the 25'00"x20'00" flat

- Write spl to get spline command. Draw the lines as shown in Figure.8.1.
- If emergency power supply is required then both SB and ESB are used. In that case C₇ wire is used from DB otherwise only SB is used and C₆ is required.

- For any electrical component C_1 wire is used from SB. For more than one C_1 the following relations must be kept in mind.

$C_5=5 \times C_1$, $C_4=4 \times C_1$, $C_3=3 \times C_1$, and $C_2=2 \times C_1$.

Report :

1. Design conduit layout of a flat which is completed in experiment no.7.
2. Show the number of cables in details.

Experiment No.: 09

Experiment Name: Drawing the Circuit Diagram of a flat using commercially available AutoCAD software.

Objective:

- Drawing the circuit diagram according to the conduit layout drawn in experiment 8.

Symbol and Procedure:

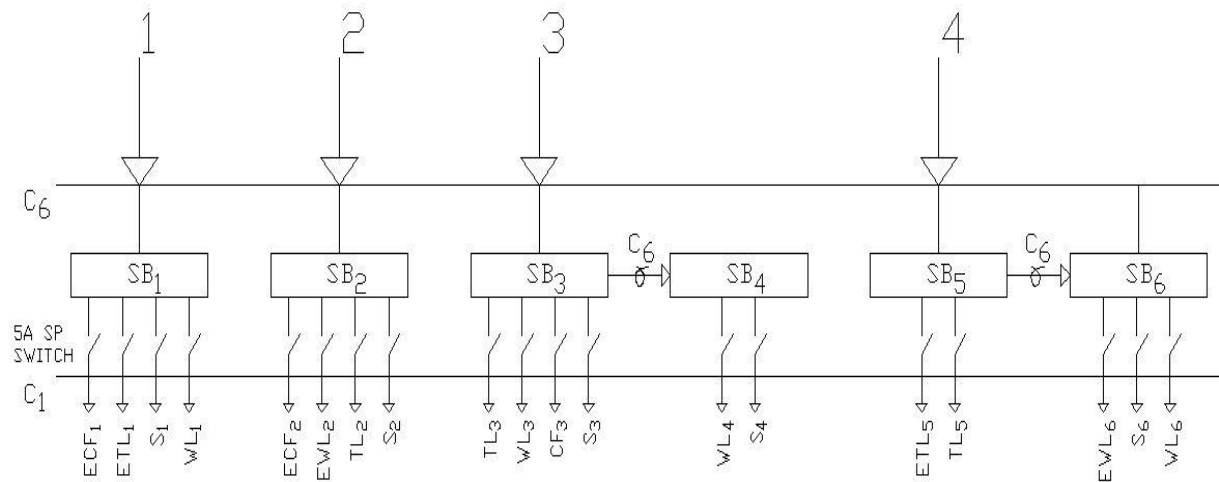


Fig. 9.1: Circuit Diagram

- Draw an arrow, a rectangle and a line between them. Write SB₁ inside the rectangle.
- Below the rectangle draw the line and arrow for ECF₁ as shown in Figure.9.1. Select the arrow and line and make an array of 4 columns and 1 row using them.
- Select all the elements and make an array of 6 columns and 1 row.
- Now edit and draw according to the given figure. Add texts as given.
- Draw C₁ and C₆ and name them.

Report :

1. Draw a single line circuit diagram of a flat which is completed in experiment no.8.
2. Complete a full project from all of the lessons of experiment no. 1 to 9.

References:

1. Bangladesh National Building Codes [BNBC]
2. Building Construction Act of Bangladesh 1952, amended in 2008.
3. IEE Regulations - IEE U.K. British Standard - B.S.
4. Introduction to Electrical Engineering - Ward R. P.
5. Mechanical Electrical system for Construction - Shutterworth.
6. Building Engineering and system design - Merrit, F. S.
7. A Text Book of Electrical Technology - B. L. Theraza.
8. Principles and Practice of Electrical Engineering - G. A. Wallace.
9. Time Saver Standard Architecture- Jhon Hancock Callender.