Rajiv Gandhi University of Knowledge Technologies Basar

LABORATORYMANUAL

COMPUTER AIDED DRAFTING LAB

DEPARTMENT OF CIVIL ENGINEERING

RGUKT BASAR

TELANGANA. -504107

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INTRODUCTION TO COMPUTER AIDED DRAFTING

Introduction:

In this section you are going to learn how to deal with the different AutoCAD Windows and theircontents.

When you start AutoCAD, three windows will be displayed on your screen:

Autocad window: AutoCAD Window consists of the following components:

- The standard menubars

- The floatingtoolbars

- The commandline

- The drawingarea

- The statusbar

Draw toolbar, Modify toolbar and Object Snap toolbar can be added to your AutoCAD Window by selecting the command View from the standard menu bar and choose any

Toolbar from the toolbar dialog box.

Today window: The use of Today window will help you:

- Start a newdrawing
- Open adrawing
- Find adrawing
- Save adrawing

Load AutoCAD symbollibraries

And you will also learn how to set up tools such as grid and snap to make drawing accurate and easier.

Starting a new drawing.

   a. From the pull-down menu, select the commandnew.

   b. Specify the new name of thedrawing.

   c. Click the OKbox.

Opening a Drawing.

   a. From the pull-down menu, select the commandOpen.

   b. Choose the drive where the drawing issaved.

   c. Select the drawing you want open from the listed drawingnames.

Saving a drawing.

a. When you type at the command line, or select from the file menu the save command AutoCAD will display a save dialog box which will allow you to save your drawing under the current name or choose anothername.

b. If the drawing is already named, you can select the Qsave command from the standard toolbar menu. While you are working on your drawing, remember to save your work every 15 to 20 minutes. This way will save you time and frustrations in case something goes wrong with yourcomputer.

Prototype Drawing.

a. From the pull-down menu, select the commandOpen.

b. From the template dialog box, select the file you want touse.

c. You May choose to erase the contents of the file or modifyit.

Any drawing can be used as a template.

Closing a drawing

You can close a drawing without exiting AutoCAD program, or you can close a drawing and exiting AutoCAD program.

a. From the file menu, select Exit command, this will close theprogram.

b. From the file menu, select New or Open command, this will allow you to continue +-using theprogram.

Active assistance window: This window will display information about anyAutoCAD command.

EXERCISE 2

SOFTWARE FOR CAD - INTRODUCTION TO DIFFERENT SOFT WARES

Software is an interpreter or translator used to perform a specific type of application in CAD.

The user may utilize the software for analysis, designing and drafting of buildings, hydraulic structures, wastewater treatment plants BASIC, FORTRAN, PASCAL, C, C++, VB, VC++, JAVAetc.

For drafting, commercially available software like AUTOCAD, COREL DRAW, VIRTUAL ENGINEERING ETC., can be used.

EXERCISE 3

PRACTICE EXERCISE ON CAD SOFTWARE

Drawing alphabets

Commands to be used is line

To draw horizontal and vertical lines keep ortho on To

draw inclined lines keep the ortho off

Draw the alphabets as per the given dimensions
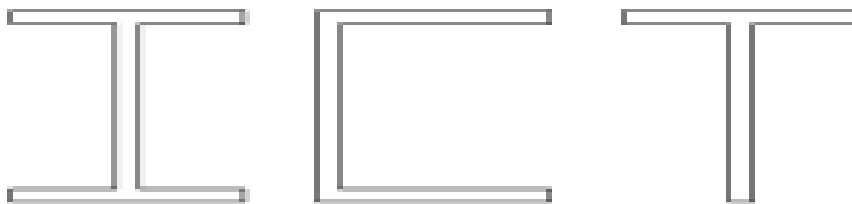
Drawing cross sections

(I, C, T, angles, solid and hollow sections)

Commands to be used is line

To draw horizontal and vertical lines keep ortho on To

draw inclined lines keep the ortho off

Draw the alphabets as per the given dimensions

EXERCISE 4

DRAWING OF PLANS OF BUILDINGS USING SOFTWARES

a) Single storey building, b) Multi storey building

1. Open AutoCAD and create the outline of the house's exterior: Click the "Home" tab, then click the "Draw" panel's "Rectangle"button

Start by setting your units to architectural (DDUNITS). Remember to create new layers for each type of objects you will draw (windows, doors, walls, roof, etc). Also use the "Render > Visual Styles > Realistic" option when adding materials. Start with layout/floor-plan.

Thickness of wall, place of windows and outer doors is enough accurate.

Now draw the bases of the walls using the dimensions are shown below. You don't need to dimension.

2. Now you will create regions out of all your wall lines. Click near the upper-left corner of the drawing window and drag toward the lower-right corner. Release the mouse to complete therectangle.

3. Define the top views of walls, beginning with clicking the rectangle tool again. Click and drag inside the house outline to define walls that separate the house's rooms. If you're not sure how you want to define your rooms, draw a single rectangle that divides the house outline through its horizontal center. Ensure the rectangle's length extends the full width of the house's outline, and that its width is as small aspossible.

4. Draw the floor plan for furnishings. Once you've defined the borders of each room, apply the rectangle tool to define the largest furnishings inside each room. For example, draw rectangles for the beds, sofas and dressers. To size these objects correctly, relate their largest dimensions to the room's largest dimension. For example, a plausible length for a bed will be somewhere between one-fourth and one-half the length of the room. Size the bed's width similarly, except base it on the bed's length, nottheroom.

5 Add rectangles for each remaining item you want in the house, working from largest to smallest. Begin visualizing your home in three dimensions: Enter "Orbit" at the command prompt at the bottom of the screen. Click and drag slightly up and left. This will move your viewpoint to one displaying the three dimensions of your house, once you make the home 3- D in the nextstep

6 Click one of your house's walls to select it, then enter "Extrude" at the command line. This command expands 2-D surfaces into 3-D objects. Size the wall to a height you desire, then click to end the extrusion. Repeat this step for each rectangle you drew, to make the house fully3-D

7. Substact the frame holes (windows anddoors)

8. Create a door layer (or make it active if you already have one) and draw a rectangle in the door opening that is 3"x 3' - put it in the middle of the door opening. Extrude it6'8".
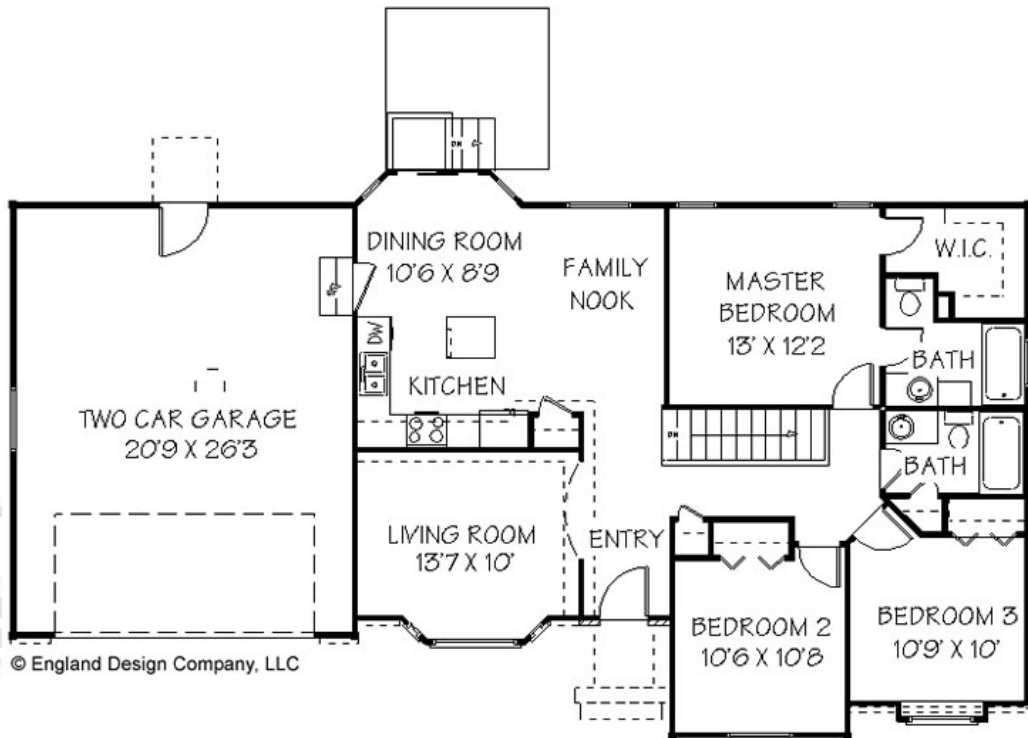
9. If you haven't saved your drawing yet, now would be a good time. Now you're going to add some windows. This will be done using a similar process as the door. You will create openings, then add the window. Create 2 rectangles in the position shown below. EXTRUDE the window 36 inches. Move them up 3'8" in the Zaxis.

10. Remember to uselayers

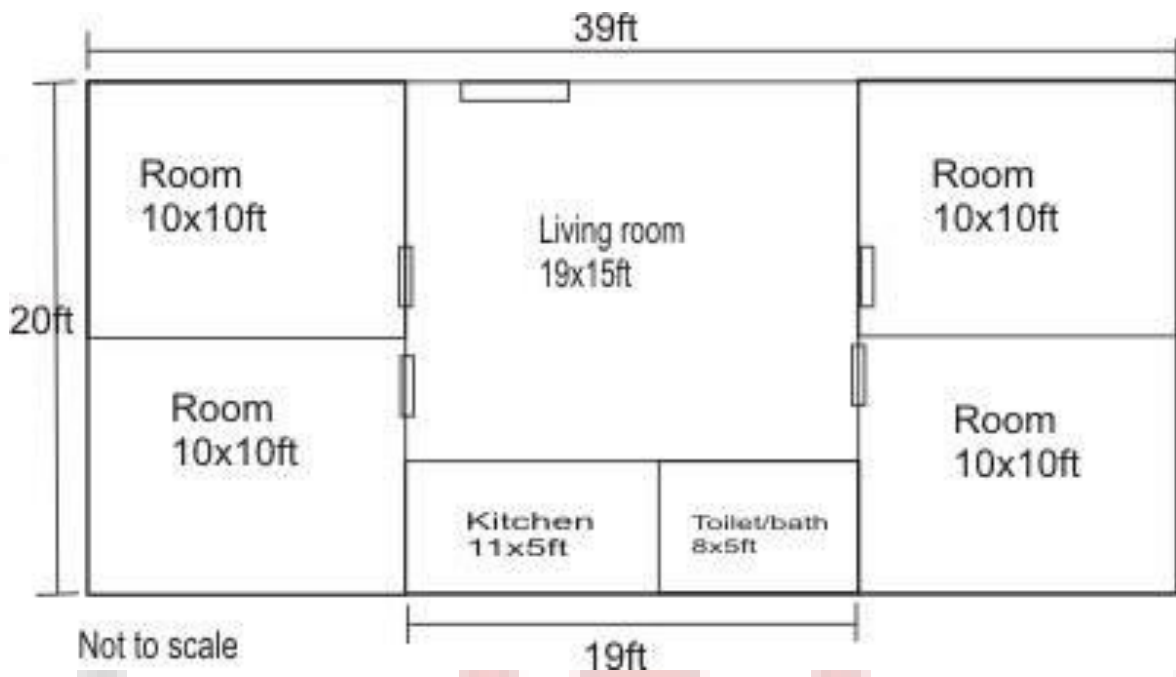11. For multi-storeyed building copy the base floor at thetop.

Plan of abuilding

DINING ROOM
10'6 X 8'9

FAMILY NOOK

MASTER BEDROOM
13' X 12'2

W.I.C.

BATH

KITCHEN

DW

TWO CAR GARAGE
20'9 X 26'3

BATH

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LIVING ROOM
13'7 X 10'

ENTRY

BEDROOM 2
10'6 X 10'8

BEDROOM 3
10'9' X 10'

39ft

Room
10x10ft

Living room
19x15ft

Room
10x10ft

20ft

Room
10x10ft

Room
10x10ft

Kitchen
11x5ft

Toilet/bath
8x5ft

Not to scale

19ft

EXERCISE 5

DEVELOPING SECTIONS AND ELEVATIONS FOR

a) Single Storey Building, B)Multi Storey Building

Once the single storeyed or multi storeyed building is drawn then the section and elevation are drawn as follows,

There are three type of sections used in engineering graphics:

a. FullSection.

b. OffsetSection.

c. HalfSection.

Each section is distinguished through its cutting plane line

The use of sectional views in engineering graphics is to make orthographic views less complicated to visualize. Cutting the view to reveal the interior will eliminate all hidden lines which will make the view easier to understand and todraw.

AutoCAD has several hatch patterns stored as a built-in library. The setting for patterns, scale for pattern, angle for pattern and object selection can be done through the hatching dialog box.
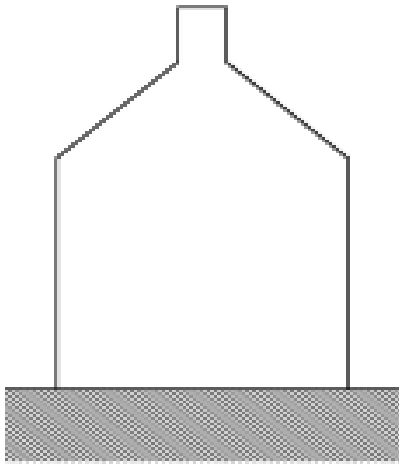
Procedure:

- Select Hatch command from the Drawpull-menu,

- Select the desiredpattern,

- Set the scalepattern,

- Set the anglepattern,

- Select the area tohatch

- Press enter to terminate the Hatchcommand.

Result:

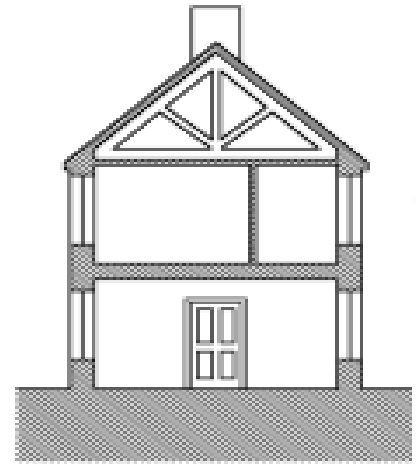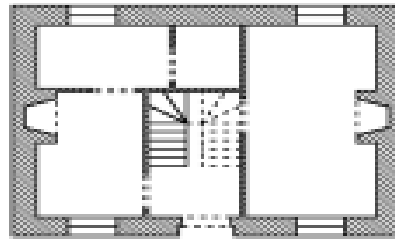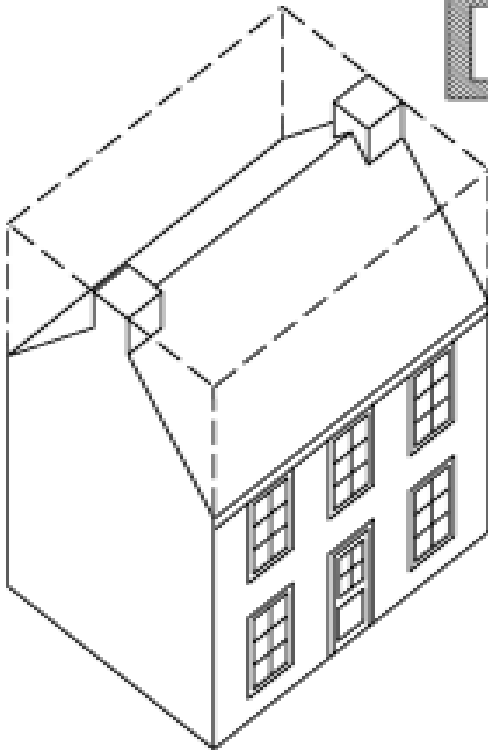**Plan , elevation and cross section of a building**

Side elevation
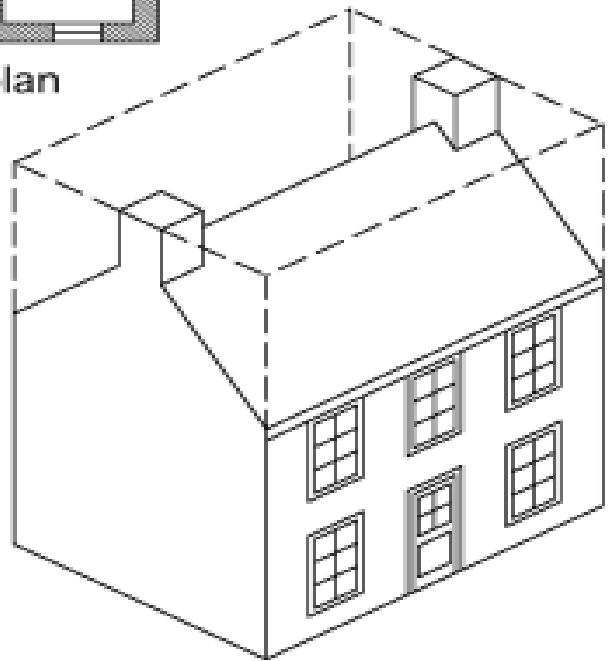
Front elevation

Section AA

Floor plan

Axonometric

Isometric

Elevation a building

EXERCISE 6

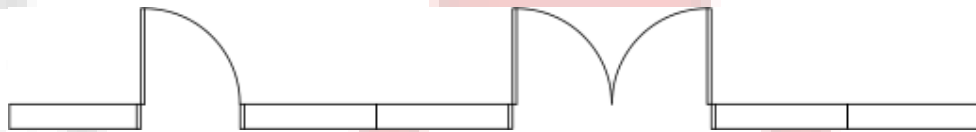## DETAILING OF BUILDING COMPONENTS LIKE

Doors

Draw a rectangle of size BXH and then add a circle with corner of rectangle as centre and h as radius

Trim the extra portion to form a door

Windows

Draw a rectangle of size BXH and add couple of lines in the middle which indicate it as a window

Result:

Singledoor   **Doubledoor**

window

EXERCISE 7

DEVELOPMENT OF WORKING OF BUILDING

Draw a Floor Plan in Autocad? Step 1:
Open the autocad.

Step 2: Draw the building outline of the house by using the "Line" command. Click the "Line" icon to activate the command. Left-click to start and end theline.

Step 3: Offset the building outline the desired thickness of the exterior wall. Use the "Offset" command. Try offsetting 1'-0" for now. You can always go back and change it.

Step 4: Draw all interior walls by using the same "Line" and "Offset" commands.

Step 5: Use the "Trim" command to trim any messy intersections on the exterior or interior conditions. Left-click the "Trim" icon to activate the tool. Select the "cutting edge" line followed by the line that you would like to trim off.

Step 6: Cut openings for doors and windows by drawing lines and then trimming away the opening. If you want a 3'-0" door, draw a line perpendicular to the wall, offset it 3'-0", and trim away the excess lines.
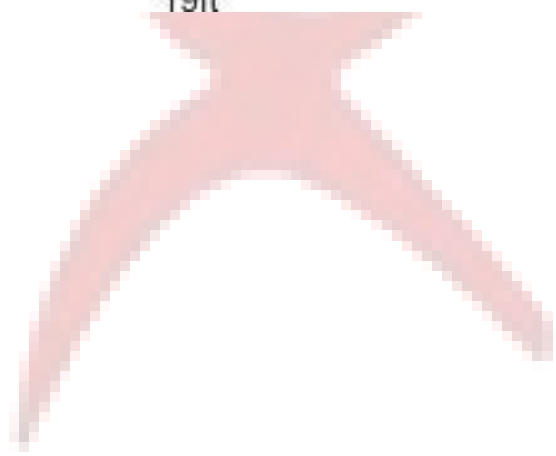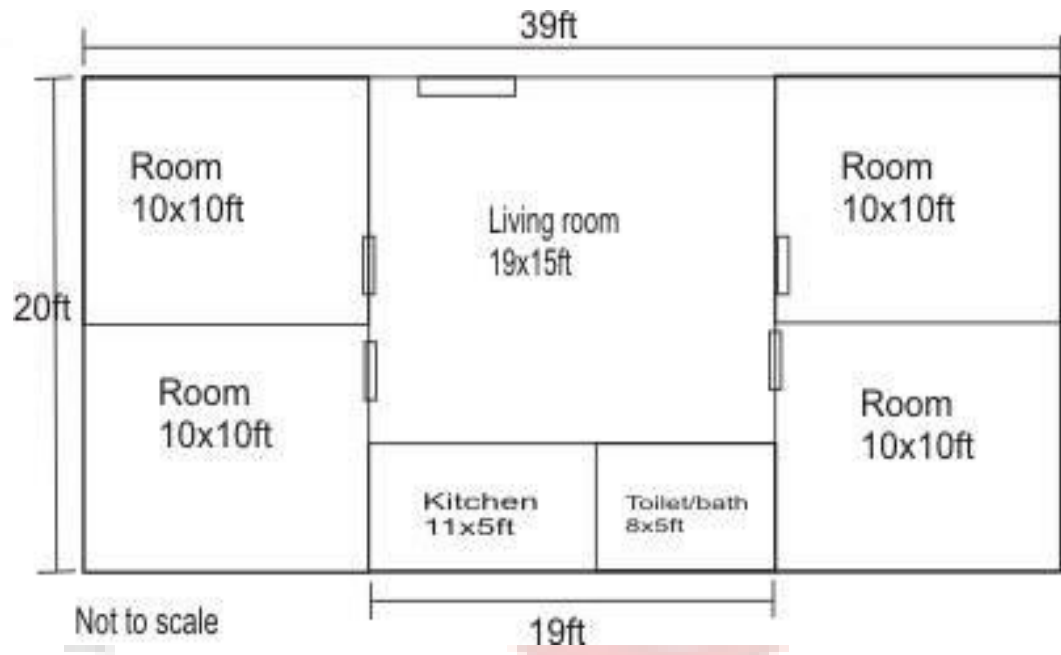
Step 7: Draw doors and windows where the new openings exist.

Step 8: Draw furniture, cabinets, and other interior items by using the "Line" and "Polyline" commands. You can easily create blocks of furniture by using a polyline. Select the polyline icon and left click to start the shape. Continue clicking until you complete the desired shape. The shape will now be grouped as one item.

Step 9: Activate the Dimension icon and click the edges of each wall that you would like to dimension to. This will give the drawing a more professional look and also gives people a sense of the space.

Step 10: Plot the drawing to a printer or to a PDF format. Hit the plot icon to open theplot settings. Choose the layout type, pen settings, and window view that you would like to use.

Result:

- 39ft
- Room 10x10ft
- Living room 19x15ft
- Room 10x10ft
- 20ft
- Room 10x10ft
- Room 10x10ft
- Kitchen 11x5ft
- Toilet/bath 8x5ft
- Not to scale
- 19ft

DRAWING WITH AUTOCAD

Drawing lines with AutoCAD

AutoCAD Entry Commands:

You can draw lines by using anyone of the five coordinate entry methods below:

- AbsoluteRectangularCoordinates;   (100,0)

- Relative Rectangular Coordinates; @ (100,0)

- Absolute Polar Coordinates; 100<90º

- Relative Polar Coordinates; @ 100<-90º

- Direct Distance Entry;100

Steps to begin drawing a line:
Type L at the command prompt and press the Enter key, or Click le

Line icon tool from the Draw toolbar.

In any case, AutoCAD will prompt you with a message asking you to specify the first point to begin your line.

You can type the coordinates (x, y) of a point, and pressenterto   start the line, (Cartesian coordinateentry).

After you have selected the first point AutoCAD will ask you to specify the next point: Enter @ 45, 0 to extend the line 45 units to the right from the last point, (Relative Cartesian coordinate entry); then

Enter @55< 30º to extend the line 55 units 30º upward from the last point, (relative polar coordinate entry).

Move the cursor horizontally to the right, and then enter 100 at the command prompt to extend the line 100 units in the horizontal direction, (direct distance entry).

Press Enter to terminate the line command.

Drawing circles with AutoCAD

You can draw circles by specifying one of the options cited below:

• The center and the radius or the diameter of thecircle.

• 2 points (2P option). The two points are located on thecircle.

• 3 points (3P option). The three points are located on thecircle.

• 2 tangents and a radius, (TTRoption).

• 3tangents, (TTToption).

Steps to begin drawing a Circle:

1- Type C at the command prompt and press the Enter key, or 2-

Click le Circle icon tool from the Draw toolbar.

In any case, AutoCAD will prompt you with a message asking you to select one of the options cited above.

A- Center Radius or Diameter Option:

a- You can type the coordinates (x, y) of a center point, or b-

Select a point on the screen, using the mouse.

c- After you have selected the center point AutoCAD will ask you to specify the radius of the circle.

d- Press Enter to terminate the command.

B- 2P (two points) Option:

AutoCAD will ask you to specify 2 points (first end point of the diameter and then the second end point of the diameter).

C- 3P (three points)Option:

AutoCAD will ask you to specify 3 points (first point on the circle, second point on the circle and third point on thecircle)

D- Tangent, Tangent, Radius Option:

AutoCAD will ask you to specify the first point on an object for the first tangent, the second point on an object for the second tangent of the circle.

E- Tangent, Tangent, Tangent Option:

AutoCAD will ask you to specify 3 points.

Drawing Arcs with AutoCAD

You can draw arcs by specifying one of the following options:

- Drawing an Arc by specifying 3 points on thescreen.
- DrawinganArcbyspecifying,thestartingpoint,thecenterofthearcandtheendingpoint.
- Drawing an Arc by specifying the Starting point, the Center of the arc, and the Angle.
- Drawing an Arc by specifying the Starting point the Center of the arc, and the Length of the arc.
- Drawing an Arc by specifying the Starting point, the End point, and the Direction of the arc.
- Drawing an Arc by using the option continue to join two lines byan arc.

TEXT WITH AUTOCAD

Text can be created and added to your drawing through the keyboard.

Selecting the text font and height:

- Select the text style command from the Format Pull-Down menu, and then make all the necessary changes on the text style dialog box, such as: Text height, text fontect.

Creating single and multiple line text:

- Select the text command from the draw pull-down menu, then select Single line text or Multiple line,or
- Type Dtext or DT at the command line,or

- Select the text icon **A** from the Drawtoolbar.

ORTHOGRAPHIC PROJECTION

Definition:

Orthographic projection is a drawing representation using the front, the top, and the left or the right side views of an object.

This drawing representation is designed to describe the object through its principle views, the relation between them, the size and the location dimensions of each one and how they are related compared to the pictorial view. The emphasis is placed mainly on the visualization of theobject.

One of the most efficient methods of creating orthographic views with AutoCAD is through the use of AutoCAD Drawing and Editing Commands, such as:

Line,

Circle,

Erase,

Copy,

Offset,

Mirror,

Block, ect.

The understanding of orthographic projection is essential for the topics that follow such as: Auxiliary views, Sectioning and Surface Intersections.

GEOMETRIC CONSTRUCTION WITH AUTOCAD

Geometric construction is based on plane geometry, including; points, lines, circles, arcs and polygons.

AutoCAD provides powerful commands for creating complex geometric figures. AutoCAD commands used in this section are:

Circle command with the TTR option (Tangent, Tangent and Radius);

Fillet command, **Trim** command **Offset** command and

Polygon command.

Every command is explained and examples are shown during the lecture session.

The techniques and applications explained are used throughout the class work and homework assignments

DIMENSIONING WITH AUTOCAD

Dimensioning is the process of describing an object by itssize.

The dimension values indicate the measurement of the dimension of the object. These dimensions are extracted automatically from the drawingview.

Here are some selected AutoCAD dimensioning commands that you will use in thiscourse:

- **Linear:** It creates distance between two points in the XYplane.

- **Aligned:** The dimension line is parallel to the distance to bedimensioned.

- **Baseline:** All dimensions are measured from the samebaseline.

- **Continue:** All dimensions are placed end toend.

- **Radius:** It measures the radius of a circle or anarc.

- **Diameter:** It measures the diameter of acircle.

- **Angular:** It measures the angle between two intersectinglines.

- **Leader:** Creates leader line withannotation

- **Center Mark:** Indicates the center of circles and arcs. It can be changed to

centerlines.

After you select the type of dimension you want to place on your drawing, AutoCAD will ask you to select two points between the distances you want to measure, then the dimension will appear automatically on the object.

FUNCTIONAL KEYS

CONTROL KEYS

Control + 0	To clear the screen
Control + 1	Properties
Control + 2	Design centre
Control + 3	Tool pallet
Control + 8	Calculator
Control + 9	To show or hide the command line window

Keys	Functions
F1.	Help.
F2.	Switches from Graphics mode to Text mode and Vice-versa.
F3.	Turns **Object Snap** ON/OFF.
F4	3d object snap
F5	Used to change the direction of cursor in isometric
F6.	Turns **Coordinate** read out ON/OFF.
F7.	Turns **Grid** display ON/OFF.
F8.	Turns **Ortho** ON/OFF.
F9.	Turns **Snap** ON/OFF.
F10	Polar tracking
F11	Object snap tracking
F12	Dynamic input