CHANDIGARH UNIVERSITY

Discover. Learn. Empower.

University Institute of Engineering

Academic Unit-1

Bachelor of Engineering (CSE, IT, CSE-IBM)

Computer Graphics using CAD Lab. (20MEP114)

Experiment No. 1

Prepared By: Paras Khullar

FUNDAMENTALS OF ENGINEERING DRAWING & COORDINATE SYSTEMS IN AUTOCAD

FUNDAMENTALS OF ENGINEERING DRAWING & COORDINATE SYSTEMS IN AUTOCAD

Course Outcome

CO Number	Title After completion of the course the students may be able to:	Level
CO1	**Sketch the different conventions and representations of engineering graphics on AutoCAD software.**	Remember & Understand
CO2	**Explain the use of engineering drawing, compare and predict the geometrical details of common engineering objects.**	Understand
CO3	Classify, examine and draw the dimensioned figures expressing information about the shape and size of physical objects	Understand
CO4	Identify and express the geometrical features of a product on AutoCAD software.	Understand
CO5	Draw orthographic views of computer components.	Understand

Will be covered in this lecture

COURSE OBJECTIVES

Students may be able to

- Understand the basic fundamentals of Engineering Drawing
- Apply the various types of lines
- Dimension the figures applying various concepts of dimensioning
- Learn the basic concepts of Scales
- Coordinate Systems in AutoCAD

Scope of CGCAD

- Engineering drawing/graphics helps to draw what is seen or perceived by the eyes.
- Engineering drawing/graphics is a means of communication between a designer and a producer.
- In different fields: Aeronautical, Agriculture, Aerospace, Architecture, Computer science, Civil engineering Mechanical, Petroleum, Electronics, Electrical Engineering

Importance of CGCAD

- Efficient communication among engineers to convey their ideas and thoughts.
- A picture speaks thousands of words. As message conveyed by picture/ sketch/sign is much more effective than a message conveyed by words.
- Engineering drawings/graphics give a better understanding of what is needed and required in the project.

Types of Lines

S.NO.	OBJECT	CONVENTION	TYPE
1.	OUT LINE OR OBJECT LINE	THICK	THICK LINE
2.	HIDDEN LINE	3 MEDIUM 1	MEDIUM LINE
3.	**PHANTOM LINE**	MEDIUM	
4.	CENTRE LINE OR LOCUS LINE	THIN	THIN LINE
5.	CONSTRUCTION, PROJECTION & SECTION LINES	THIN	
6.	DIMENSION & EXTENSION LINES	THIN 100	
7.	SHORT BREAK LINE		
8.	LONG BREAK LINE	THIN 10 TO 25	
9.	CUTTING PLANE LINE	THICK THIN 10 TO 25	

Image Source: ***Textbook of Engineering Drawing by J.S. Layal***

Fig. 1.1: Line Conventions

Line Conventions

- Visible Lines – solid thick lines that represent visible edges or contours
- Hidden Lines – short evenly spaced dashes that depict hidden features
- Section Lines – solid thin lines that indicate cut surfaces
- Center Lines – alternating long and short dashes
- Dimensioning
  - Dimension Lines - solid thin lines showing dimension extent/direction
  - Extension Lines - solid thin lines showing point or line to which dimension applies
  - Leaders – direct notes, dimensions, symbols, part numbers, etc. to features on drawing

Line Conventions

- Cutting-Plane and Viewing-Plane Lines – indicate location of cutting planes for sectional views and the viewing position for removed partial views
- Break Lines – indicate only portion of object is drawn. May be random “squiggled” line or thin dashes joined by zigzags.
- Phantom Lines – long thin dashes separated by pairs of short dashes indicate alternate positions of moving parts, adjacent position of related parts and repeated detail
- Chain Line – Lines or surfaces with special requirements

Material Conventions

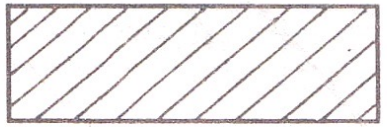
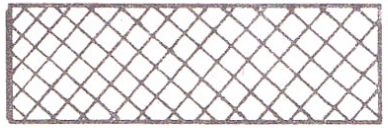
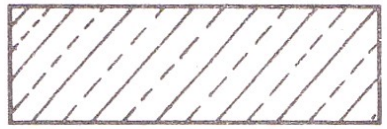
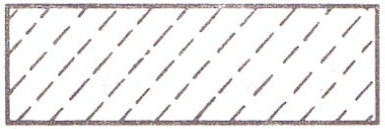
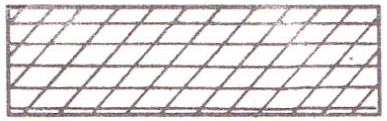
TYPE	MATERIAL	CONVENTION
METALS	STEEL, CAST IRON, COPPER AND ITS ALLOYS ALUMINIUM AND ITS ALOYS, ETC.	
	LEAD, ZINC, TIN, WHITE METAL, ETC.	
	BRASS, BRONZE, GUN METAL, ETC.	
GLASS	GLASS	
PACKING AND INSULATING MATERIALS	PORCELAIN, STONE WARE, MARBLE, SLATE, ETC.	
	ASBESTOS, FIBRE, FELT, SYNTHETIC RESIN PRODUCTS, PAPER, CORK, LINOLEUM, RUBBER, LEATHER, WAX, INSULATING AND FILLING MATERIALS	

Image Source: *Textbook of Engineering Drawing by J.S. Layal*

Fig. 1.2.1: Material Conventions

Material Conventions

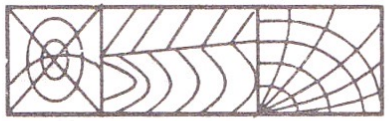
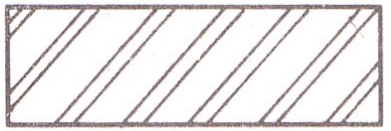
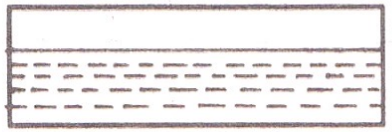
WOOD	WOOD, PLYWOOD, ETC.	
EARTH	EARTH	
BUILDING CONSTRUCTION	BRICK WORK, MASONRY, FIRE BRICKS, ETC.	
CONCRETE	CONCRETE	
LIQUIDS	WATER, OIL, PETROL, KEROSINE, ETC.	

Fig. 1.2.2: Material Conventions

Image Source: ***Textbook of Engineering Drawing by J.S. Layal***

Example of Types of Lines

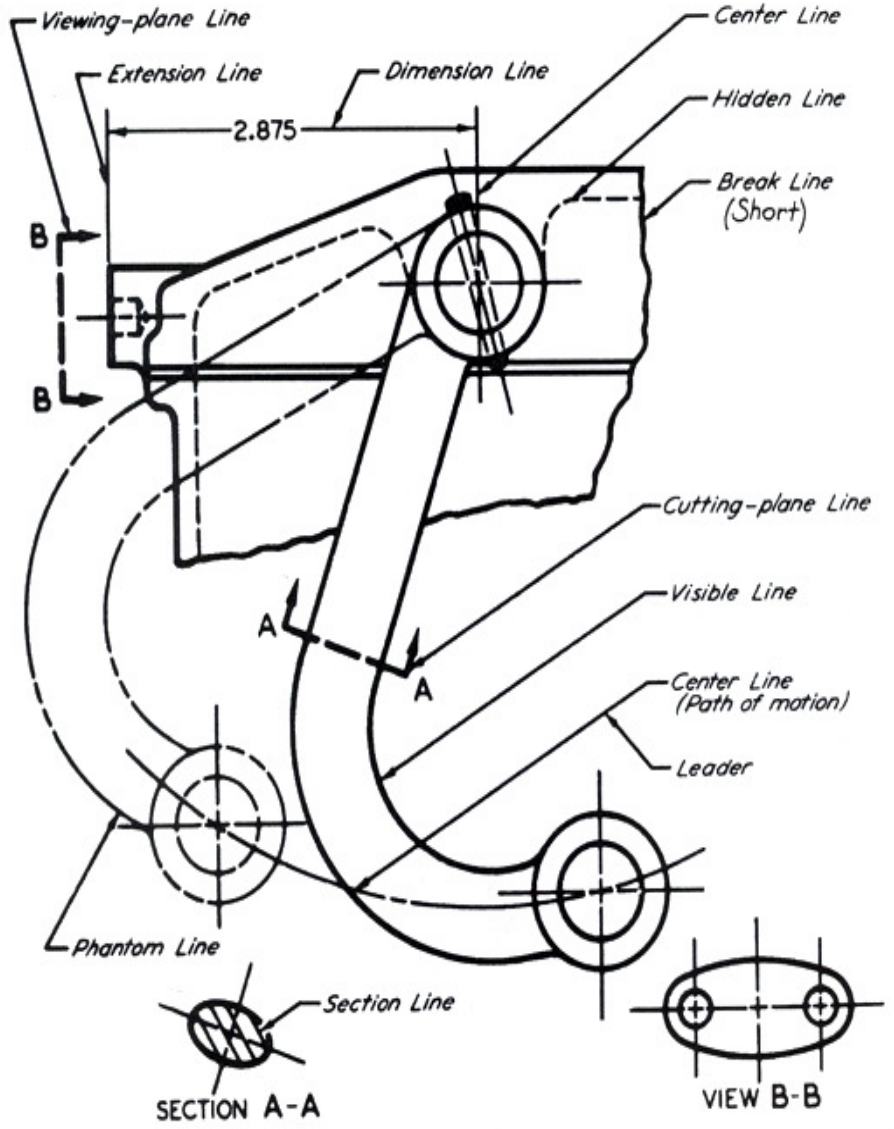


Fig. 1.3: Example of Line Conventions

Image Source: ***Textbook of Engineering Drawing by P.S. Gill***

Dimensioning Guidelines

- Dimensions define the size of a feature or its location relative to other features or a frame of reference, called a datum.
- The basic rules of dimensioning are:
  1. Dimension where the feature contour is shown
  2. Place dimensions between the views
  3. Dimension off the views
  4. Dimension mating features for assembly

Dimensioning Guidelines (Continued)

- The basic rules of dimensioning are:
  5. Do not dimension to hidden lines
  6. Stagger dimensioning values
  7. Create a logical arrangement of dimensions
  8. Consider fabrication processes and capabilities
  9. Consider inspection processes and capabilities

Units of Measurement

- Length
  - English - Inches, unless otherwise stated
    - Up to 72 inches – feet and inches over
  - SI – millimeter, mm
- Angle
  - degrees, minutes, seconds

Systems of Dimensioning

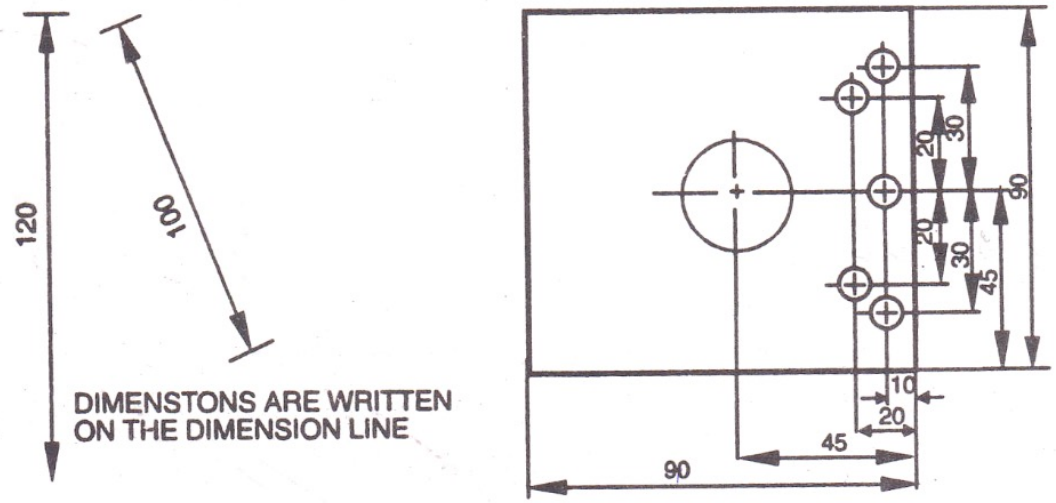


Fig. 1.4: Aligned System of Dimensioning

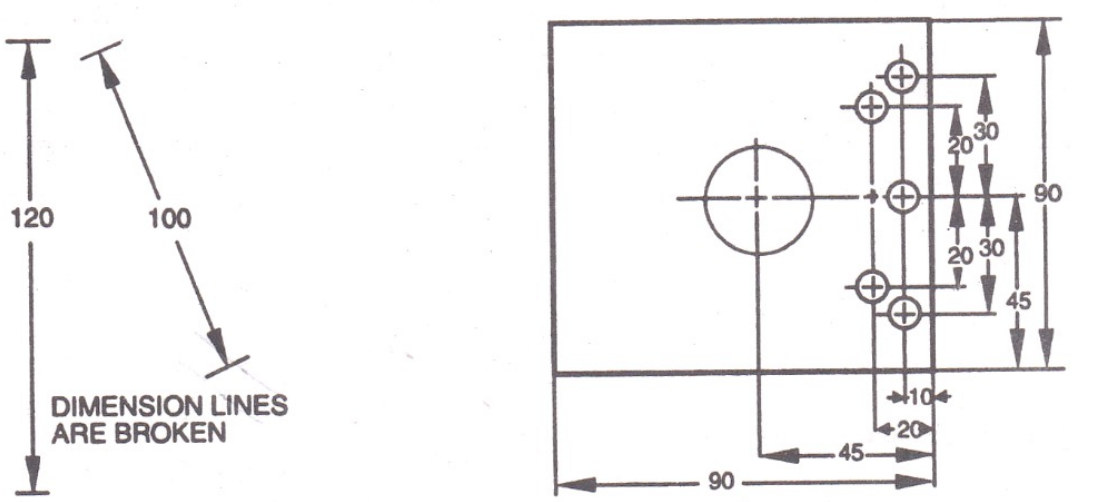


Fig. 1.5: Unidirectional System of Dimensioning

Image Source: ***Textbook of Engineering Drawing by J.S. Layal***

Types of Dimensioning

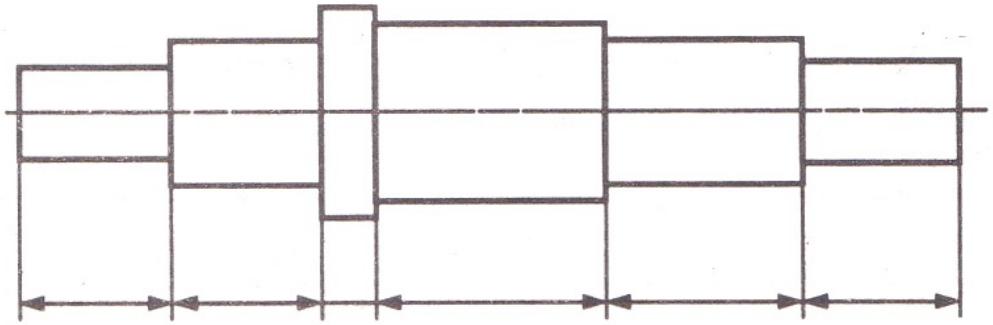


Fig. 1.6: Chain Dimensioning

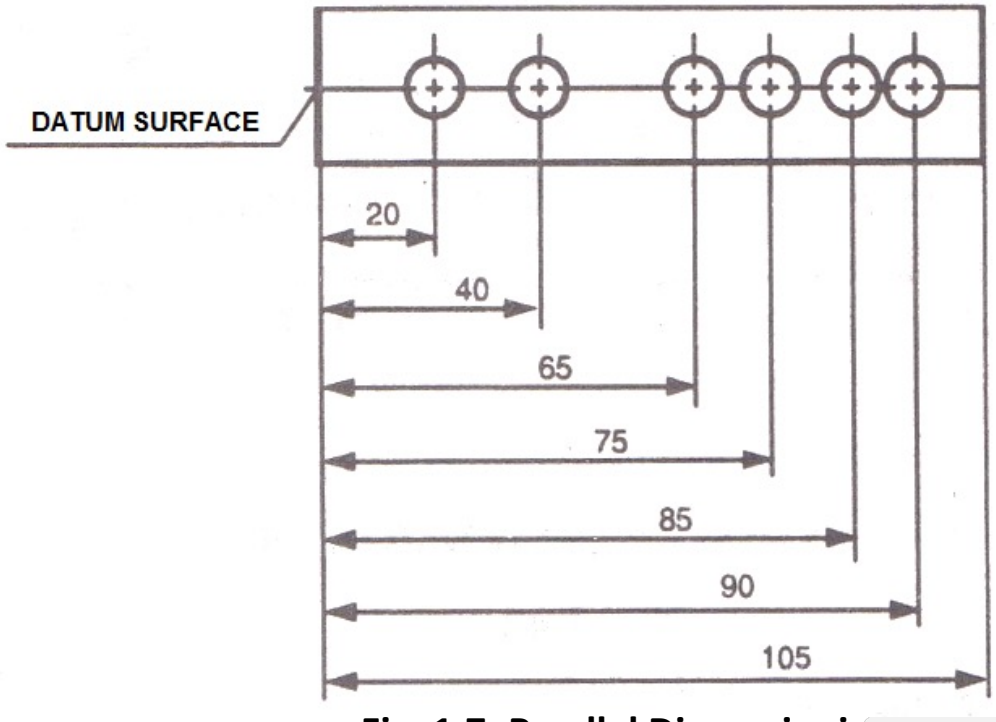


Fig. 1.7: Parallel Dimensioning

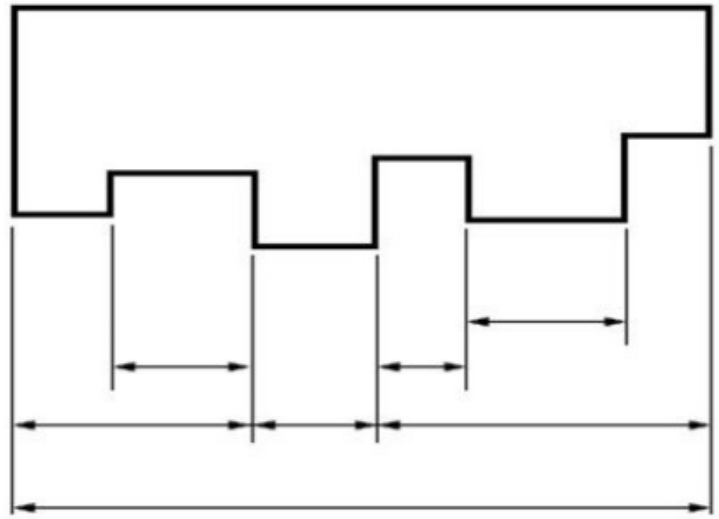


Fig. 1.8: Combined Dimensioning

Image Source: ***Textbook of Engineering Drawing by J.S. Layal***

Types of Dimensioning

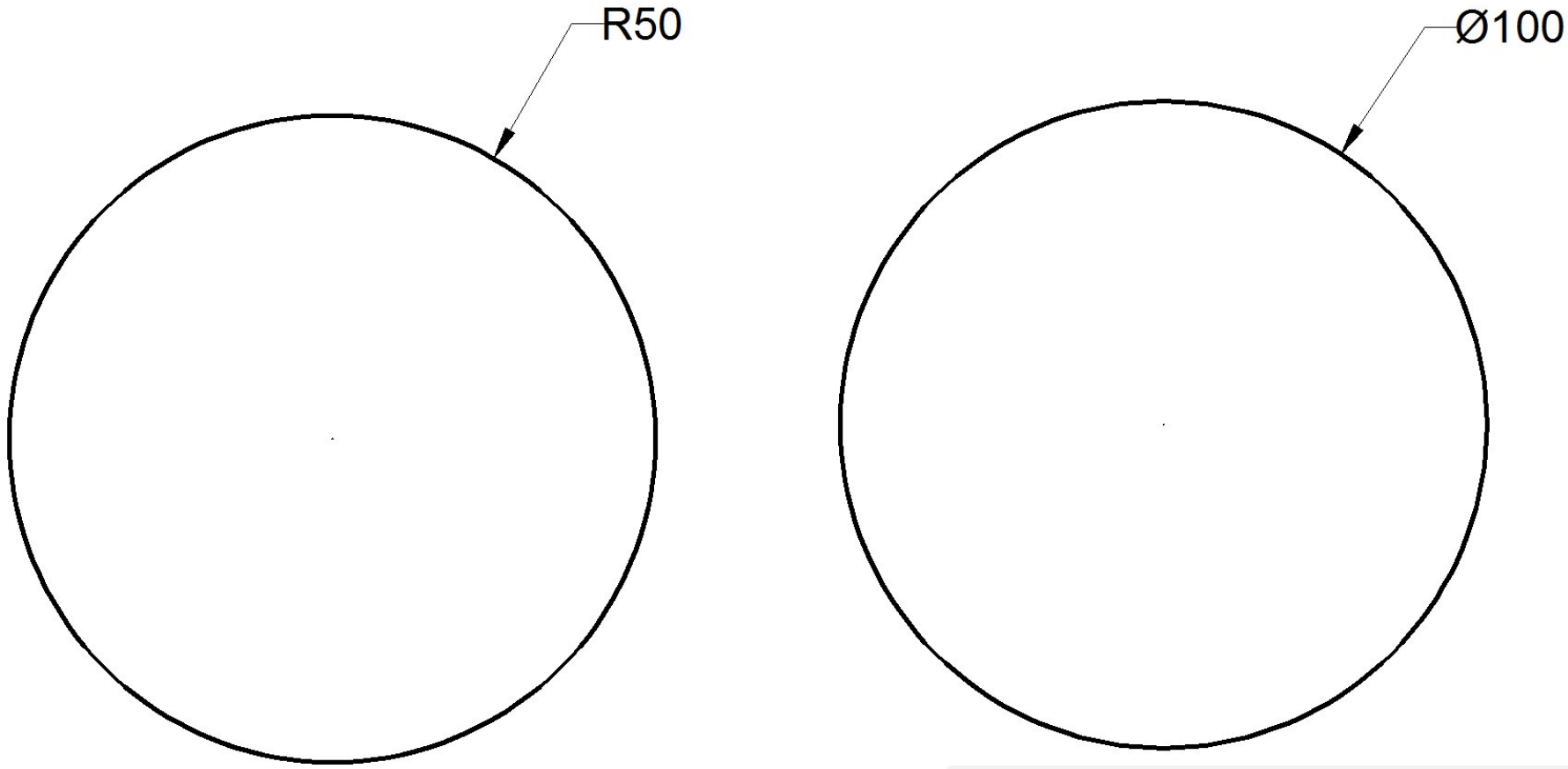


Fig. 1.9: Circular Dimensioning

Image Source: ***Self-Made***

Scales

- Dimensions of large objects must be reduced to accommodate on standard size drawing sheet
- This reduction creates a scale of that reduction ratio, which is generally a fraction.
- That ratio is called REPRESENTATIVE FRACTION
- Reducing scale is represented by 1:X; X is reducing factor
- Full scale is represented by 1:1
- Enlarging scale is represented by X:1; X is enlarging factor

Scales

- Representative Fraction (R.F)

  = Length of object on drawing/Actual Length of the object

- Length Of Scale = R.F. X Max. Length To Be Measured

Computer Aided Drafting/Drawing

- The drawings are usually made with the help of commercial software such as AutoCAD, solid works etc.

AutoCAD Interface

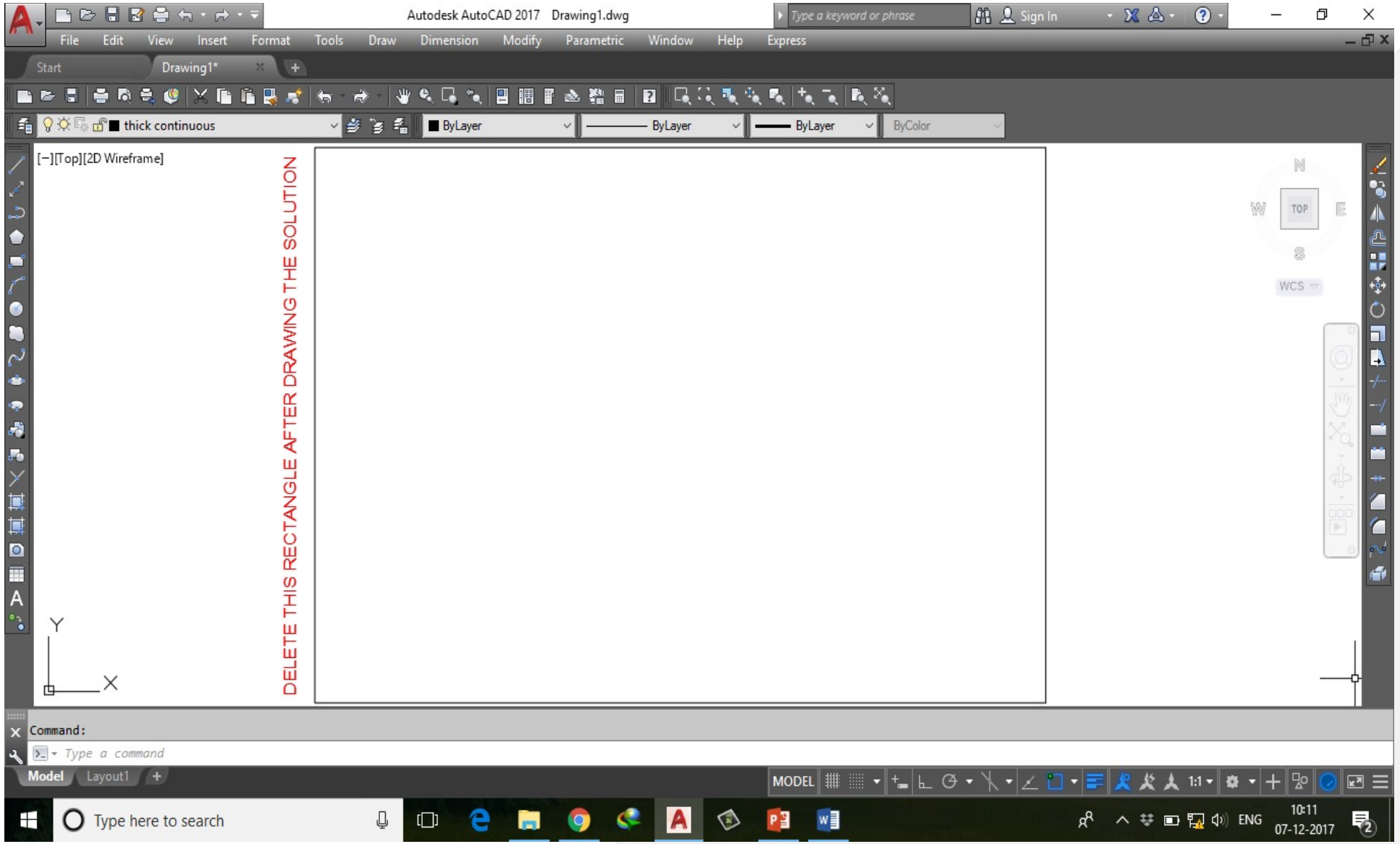


Image Source: *Self-Made*

Fig. 1.10: AutoCAD Interface

AutoCAD Draw Commands Toolbar

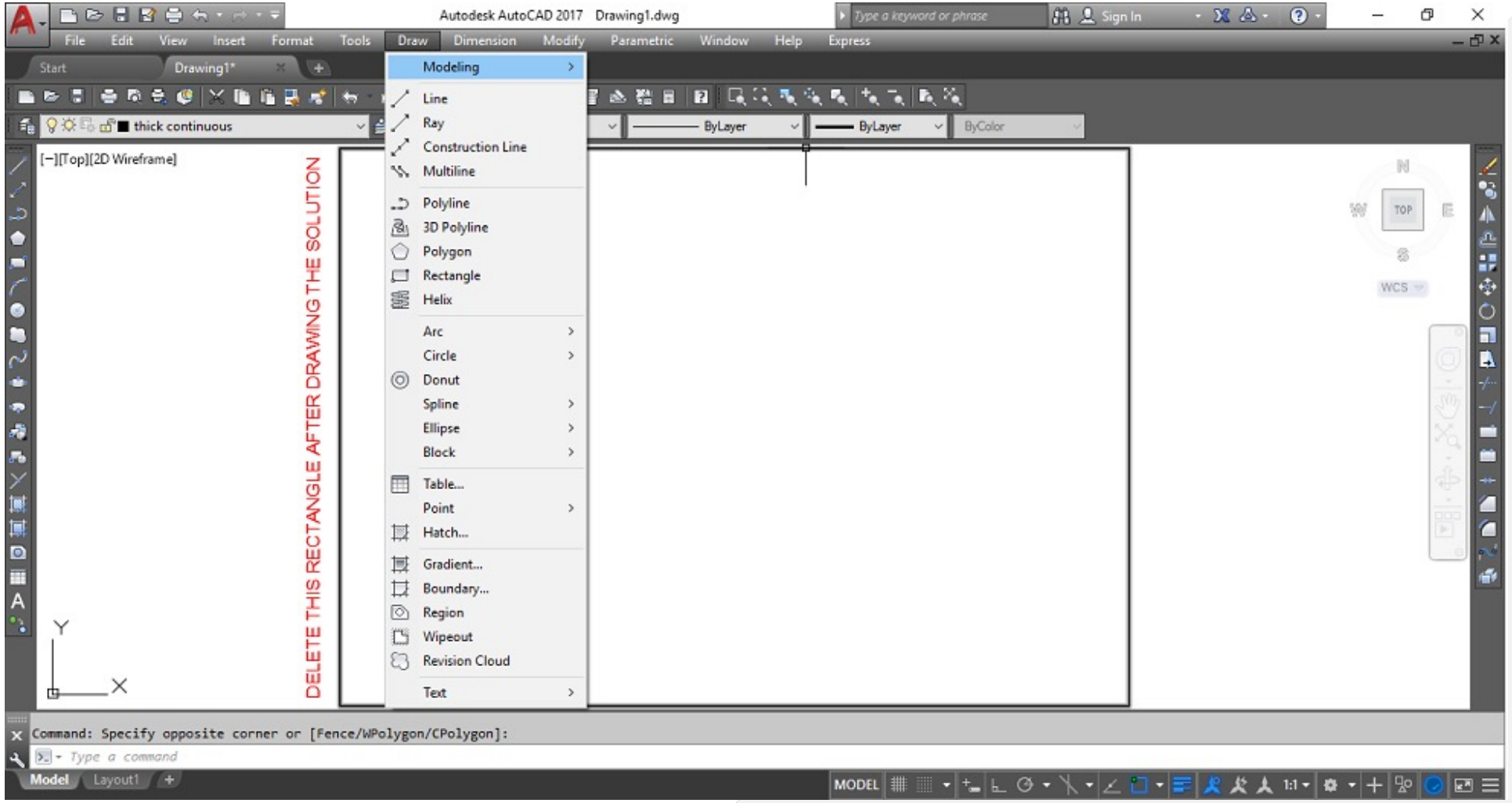


Fig. 1.11: AutoCAD Draw Toolbar

Image Source: *Self-Made*

Modify and Dimensioning Commands Toolbars

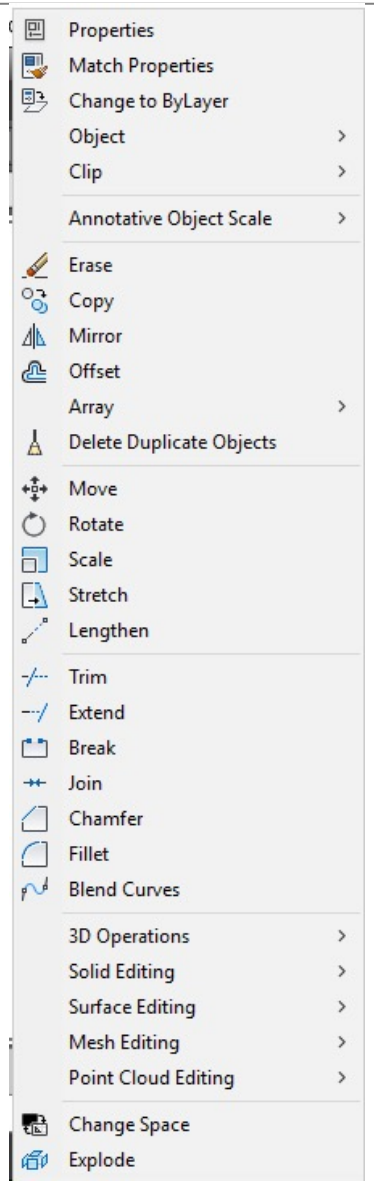


Fig. 1.12: Modify Toolbar

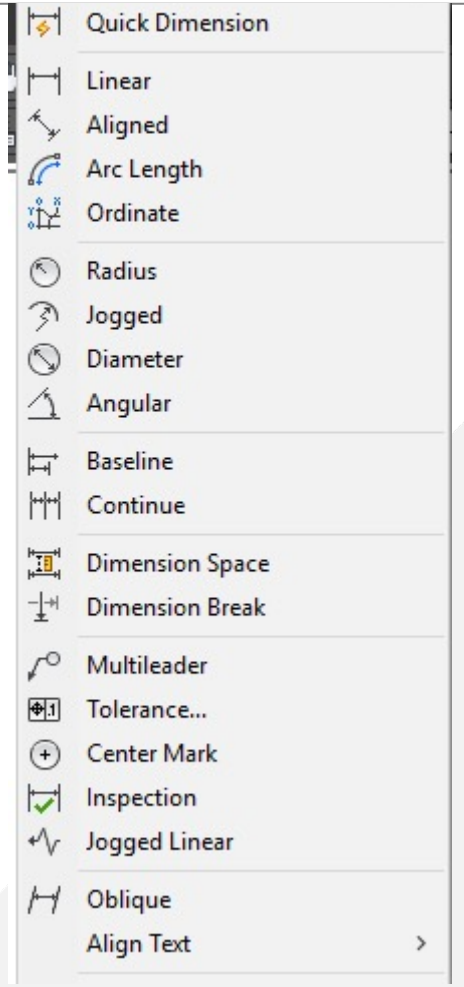


Fig. 1.13: Dimensioning Toolbar

Image Source: ***Self-Made***

Layout View

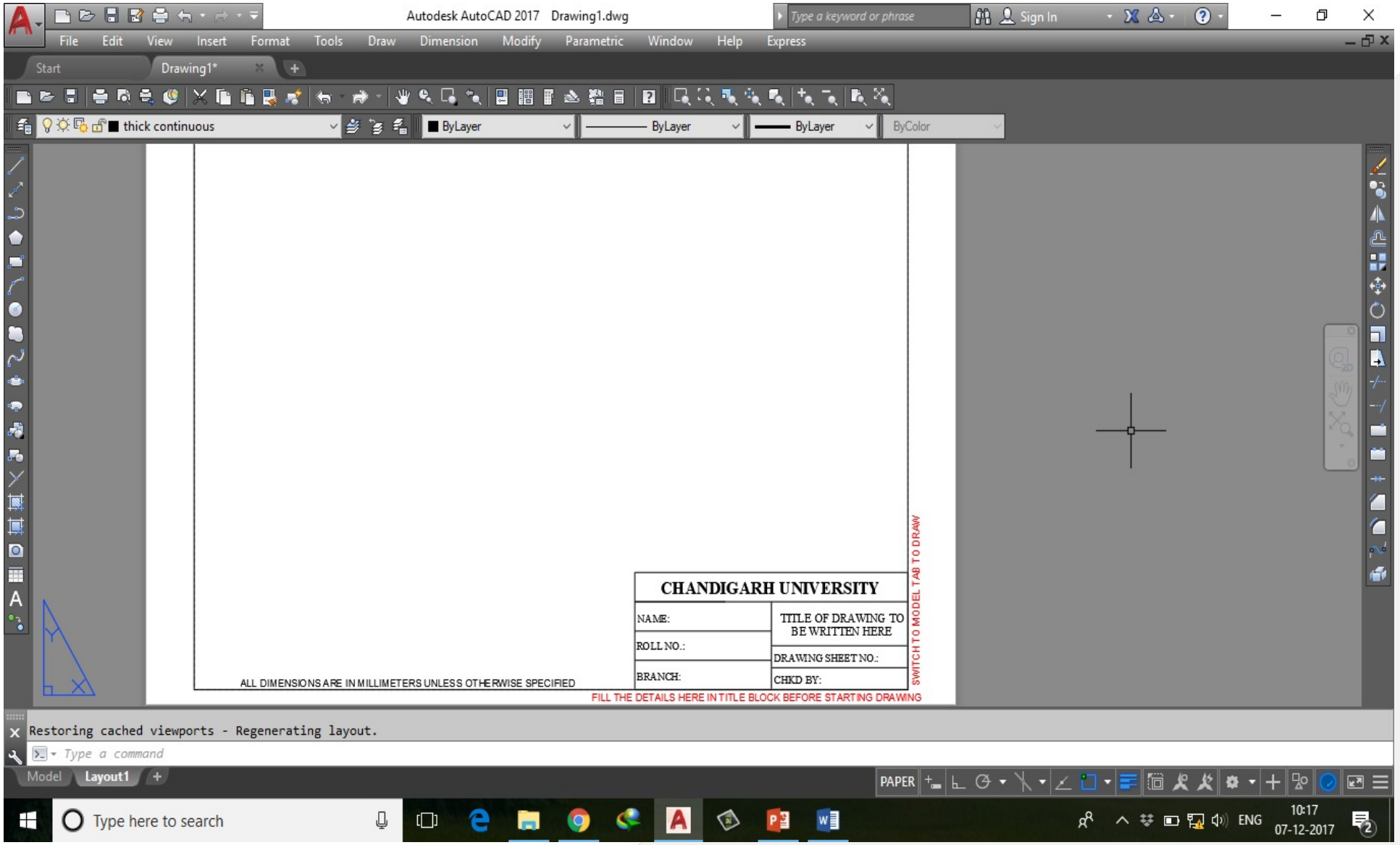


Image Source: ***Self-Made***

Fig. 1.14: Layout View of AutoCAD

Plotting of Sheet

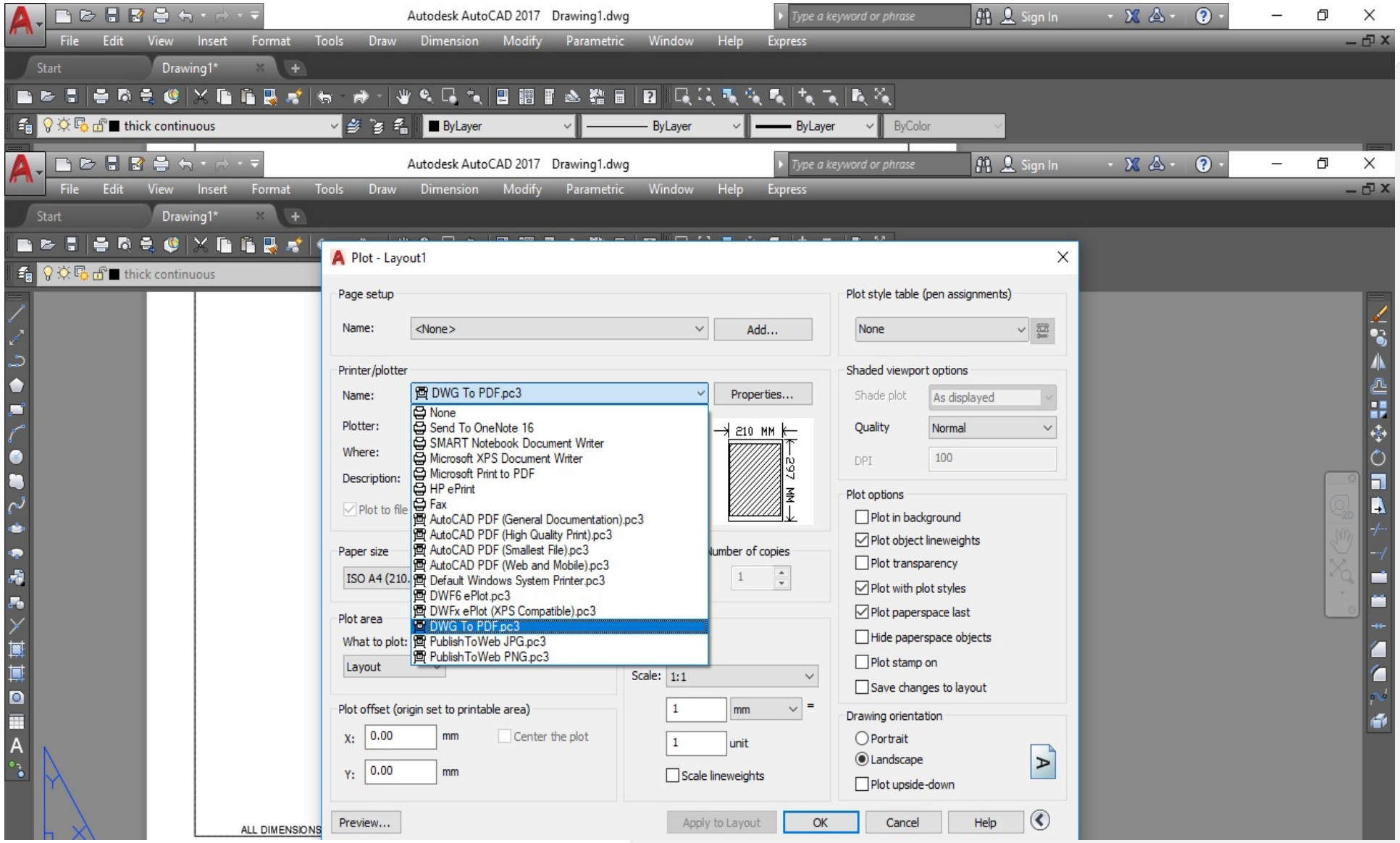


Image Source: *Self-Made*

Fig. 1.15: Plotting of Sheet

Coordinate Systems in AutoCAD

1. Absolute Coordinate System:

- The actual coordinates of the system w.r.t. the first point or origin are used to draw the figures.
- Line command is used in the system

Syntax: Absolute *X coordinates, Absolute Y coordinates*

Coordinate Systems in AutoCAD

1. Absolute Coordinate System:

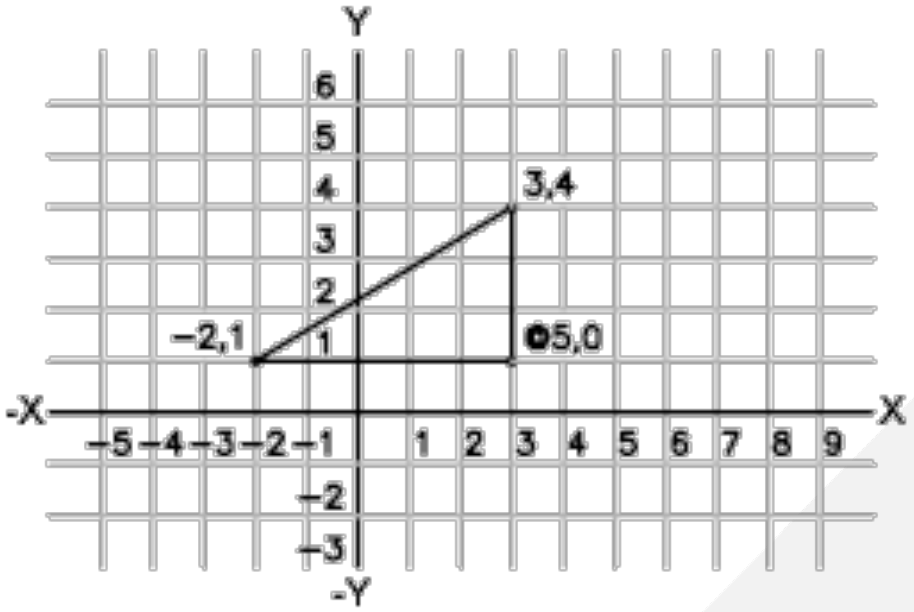


Fig. 1.16: Absolute Coordinate system

Image Source: ***knowledge.autodesk.com***

Coordinate Systems in AutoCAD

2. Relative Coordinate System:

- The previous point is considered to the origin of the figure.
- Line is drawn by inserting the distance moved in X-dir and distance moved in Y-dir.

Syntax: ***@Distance moved in X-dir., Distance moved in Y-dir.***

Coordinate Systems in AutoCAD

2. Relative Coordinate System:

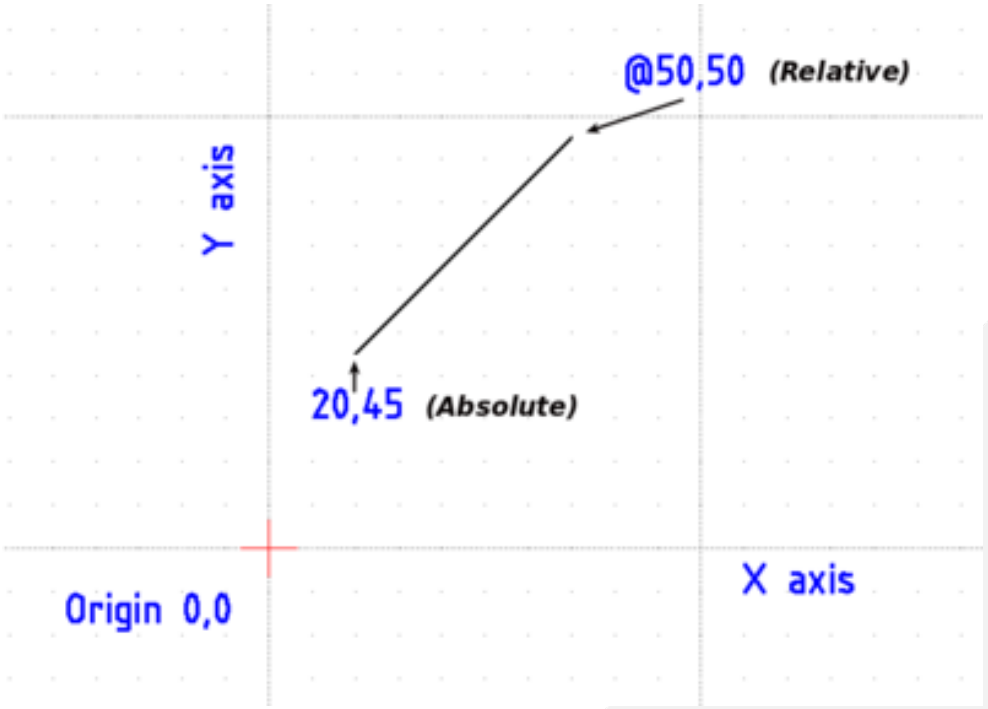


Image Source: *wiki.librecad.org*

Fig. 1.17: Relative Coordinate system

Coordinate Systems in AutoCAD

3. Polar Coordinate System:

- Based on the polar coordinates which are **(r,θ).**
- Distance moved and at what angle , is specified in this system.

Syntax: *@Distance moved<Angle w.r.t. 0°*

Coordinate Systems in AutoCAD

3. Polar Coordinate System:

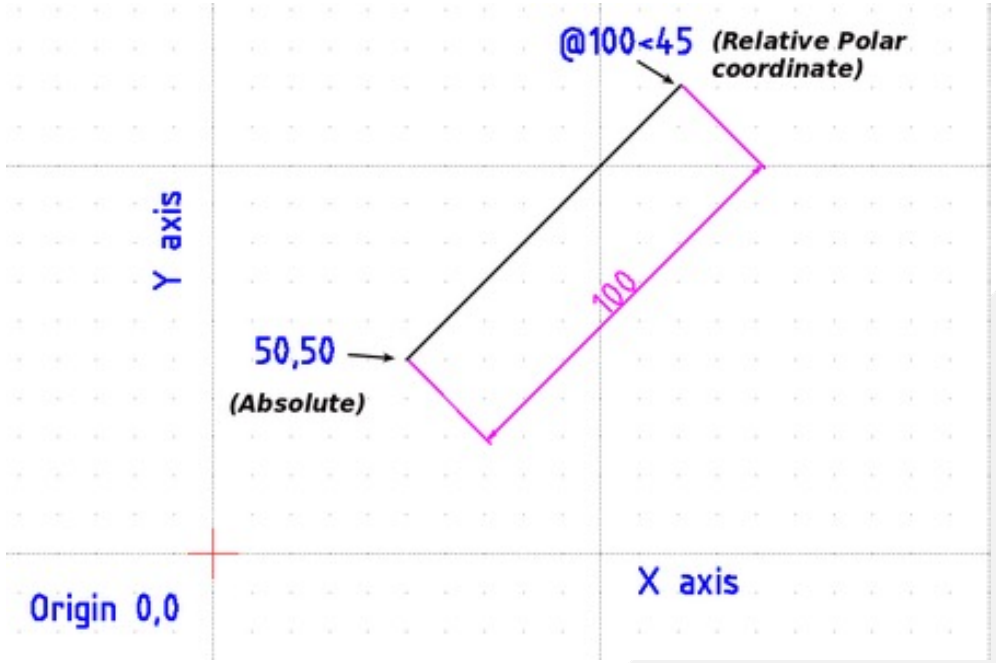


Image Source: *wiki.librecad.org*

Fig. 1.18: Polar Coordinate system

Applications

- Scales are used for construction of roads and buildings to reduce and enlarge dimensions.
- Representation of materials are used for building drawings.
- Conventions of lines are used in machine drawing to represent various parts of machines.

Assessment Pattern

Sr. No.	Type of Assessment Task	Weightage of actual conduct	Frequency of task	Final Weightage in Internal Assessment (Prorated Marks)	Remarks
1.	Practical Worksheet (In Journal Category) and Class-room Learning	20 marks for each experiment	8-10 experiments	40 marks	Depending upon no. of experiments
2.	Mid-Term Test	20 marks	1 per semester	12 marks	At-least after the completion of 5 experiments.
3.	Discussion Forum/Short Digital Assignment/Journal to submit design/Portfolio	4 marks for each task	1 per semester	4 marks	
4.	Presentation*	------		Non Graded: Engagement Task	
5.	Attendance and BB Engagement Score	-----		4 marks	End Semester

Table 1.1: Assessment Pattern

Summary

In this PPT, we have learnt:

- Scope and importance of Computer Graphics using CAD
- Line and material conventions
- Concept of Dimensioning
- Basics of AutoCAD and interface
- Coordinate systems in AutoCAD

Recommended Books

- Rhodes R.S, Cook L.B; Basic Engineering Drawing, Pitman Publishers,
- Rana and Shah; Engineering Drawing, Pearson Education India Publishers.
- Jolhe D.A; Engineering Drawing: With an Introduction to AutoCAD, Tata McGraw Hill
- Gill P.S; Engineering Drawing, S.K. Kataria and Sons Publications.
- Dhawan R. K; Engineering Drawing, S. Chand and Sons Publishers.

References

- Gill P.S; Engineering Drawing ,5th Edition, S.K. Kataria and Sons Publications, 2011.
- Aggarwal B; Engineering Drawing, 1st Edition, Tata McGraw Hill Publications,2008.
- Dhawan R. K; Engineering Drawing, 7th Edition ,S. Chand and Sons Publishers.
- BhattN.D; Engineering Drawing,50th Edition, Charotar Publication,2011.
- Layal J.S.; Engineering Drawing, Eagle Publications.

Image Links

- https://www.slideshare.net/shameem.mist/engineering-drawing
- https://knowledge.autodesk.com/support/autocad-lt/learn-explore/caas/CloudHelp/cloudhelp/2019/ENU/AutoCAD-LT/files/GUID-F64F8008-E1C0-49CC-A268-A6B8C6E9B566-htm.html
- https://wiki.librecad.org/images/thumb/8/8d/Selection_026.png/400px-Selection_026.png
- https://wiki.librecad.org/images/thumb/a/a0/Selection_028.png/450px-Selection_028.png

THANK YOU

For queries
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