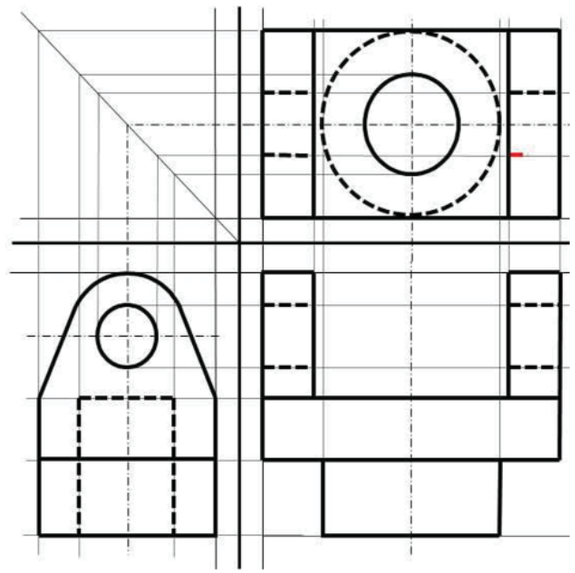
Engineering Drawing II



Government of Nepal
Ministry of Education, Science and Technology
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Technical and Vocational Stream

Learning Resource Materials

ENGINEERING DRAWING-II

(Grade 10)

Secondary Level

Civil Engineering

Government of Nepal
Ministry of Education, Science and Technology
Curriculum Development Centre
Sanothimi, Bhaktapur

Publisher : Government of Nepal

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Sanothimi, Bhaktapur

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Preface

The curriculum and curricular materials have been developed and revised on a regular basis with the aim of making education objective-oriented, practical, relevant and job oriented. It is necessary to instill the feelings of nationalism, national integrity and democratic spirit in students and equip them with morality, discipline and self-reliance, creativity and thoughtfulness. It is essential to develop in them the linguistic and mathematical skills, knowledge of science, information and communication technology, environment, health and population and life skills. it is also necessary to bring in them the feeling of preserving and promoting arts and aesthetics, humanistic norms, values and ideals. It has become the need of the present time to make them aware of respect for ethnicity, gender, disabilities, languages, religions, cultures, regional diversity, human rights and social values so as to make them capable of playing the role of responsible citizens with applied technical and vocational knowledge and skills. This Learning Resource Material for Civil Engineering has been developed in line with the Secondary Level Civil Engineering Curriculum with an aim to facilitate the students in their study and learning on the subject by incorporating the recommendations and feedback obtained from various schools, workshops and seminars, interaction programs attended by teachers, students and parents.

In bringing out the learning resource material in this form, the contribution of the Director General of CDC Dr. Lekhnath Poudel, Dr. Jagatkumar Shrestha, Dr. Kamal Thapa, Dr. Bharat Mandal, Purushotam Chapagai, Jagadishchandra Karki, Krishn Thapa, Geeta Lamichhane is highly acknowledged. The book is written by Kedarnath Dahal and the subject matter of the book was edited by Badrinath Timalsina and Khilanath Dhamala. CDC extends sincere thanks to all those who have contributed in developing this book in this form.

This book is a supplimentary learning resource material for students and teachrs. In addition they have to make use of other relevnt materials to ensure all the learning outcomes set in the curriculum. The teachers, students and all other stakeholders are expected to make constructive comments and suggestions to make it a more useful learning resource material.

2076 BS

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Content

Unit: 1

Overview about drawing

1. Objective

- to define terms of drawing
- to identify types of building structures
- to know by-laws and codes
- to know the symbols and conventional signs

2. Content

1.1 Introduction to types of drawings

An engineering drawing, a type of technical drawing, is used to fully and clearly defined requirements for engineered items.

Engineering drawing (the activity) produces engineering drawings (the documents). More than merely the drawing of pictures, it is also a language, a graphical language that communicates ideas and information from one mind to another.

Following are the types of drawing:

- Architectural drawing
- Structural drawing
- Service drawing
- Electrical drawing
- Sanitary drawing
- Detailed drawing etc.

1.2 Architectural drawing, structural drawing, services drawing, detail drawings

Architectural drawing:

An architectural drawing or architect's drawing is a technical drawing of a building (or building project) that falls within the definition of architecture. Architectural drawings are used by architects and others for a number of purposes: to develop a design idea into a coherent proposal, to communicate ideas and concepts, to

convince clients of the merits of a design, to enable a building contractor to construct it, as a record of the completed work, and to make a record of a building that already exists.

Architectural drawings are made according to a set of conventions, which include particular views (floor plan, section etc.), sheet sizes, units of measurement and scales, annotation and cross referencing. Conventionally, drawings were made in ink on paper or a similar material, and any copies required had to be laboriously made by hand. The twentieth century saw a shift to drawing on tracing paper, so that mechanical copies could be run off efficiently.

The development of the computer had a major impact on the methods used to design and create technical drawings, making manual drawing almost obsolete and opening up new possibilities of form using organic shapes and complex geometry. Today the vast majority of drawings are created using CAD software

Structural drawing:

A structural drawing, a type of Engineering drawing, is a plan or set of plans for how a building or other structure will be built. Structural drawings are generally prepared by registered professional structural engineers, and informed by architectural drawings. They are primarily concerned with the load-carrying members of a structure. They outline the size and types of materials to be used, as well as the general demands for connections. They do not address architectural details like surface finishes, partition walls, or mechanical systems. The structural drawings communicate the design of the building's structure to the building authority to review. Structural drawings are also included with a proposed building's contract documents, which guide contractors in detailing, fabricating, and installing parts of the structure.

Detail drawings:

Detail drawings provide a detailed description of the geometric form of a part of an object such as a building, bridge, tunnel, machine, plant, and so on. They tend to be large-scale drawings that show in detail parts that may be included in less detail on general arrangement drawings.

Detail drawings may be used to demonstrate compliance with regulations and other requirements, to provide information about assembly and the junctions between components, to show construction details, detailed form, and so on, that would not be possible to include on more general drawings.

They may include dimensions, tolerances, notation, symbols and specification information, but this should not duplicate information included in separate specifications as this can become contradictory and may cause confusion.

They may consist of two-dimensional orthogonal projections showing plans, sections and elevations and may be drawn to scale by hand, or prepared using Computer Aided Design (CAD) software. However, increasingly, building information modeling (BIM) is being used to create detailed three-dimensional representations of buildings and their components.

Detail drawings may be confused with ‘detailed design drawings’ which might describe the drawings produced during the detailed design stage, (sometimes referred to as 'developed design' or 'definition'). Detailed design is the process developing the design so that it is dimensionally correct and co-ordinated, describing all the main components of the building and how they fit together. Not all drawings produced during this stage will necessarily be detail drawings.

They are also distinct from the definition of ‘working drawings’ which provide dimensioned, graphical information that can be used by a contractor to construct the works, by suppliers to fabricate components of the works or to assemble or install components. Again, not all working drawings will necessarily be detail drawings.

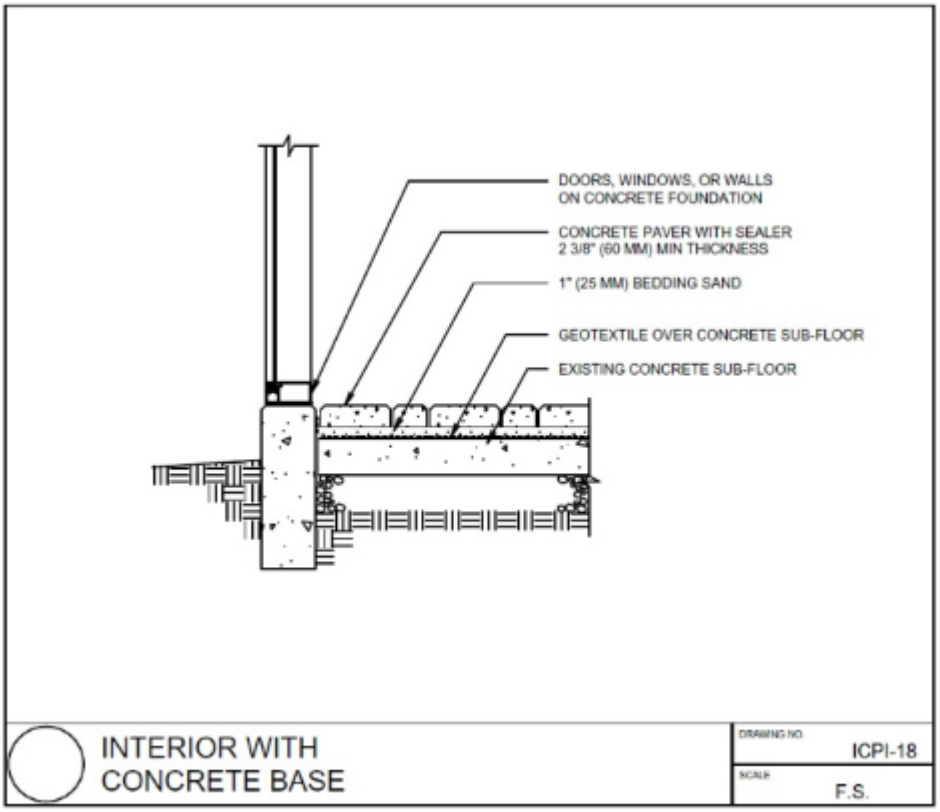

Fig. Sample of detailed drawing

1.3 Types of building structure

Following are the types of building structures

- **Sub-structure**

It is the lower portion of the building usually located below the ground level which transmit the load of the super structure to the supporting soil. Its basic function is to transmit the dead load, live load and other load to the sub-soil or sub grade soil. In the sub-structure it consists of mainly footing. This is the lowest part of the building or any construction work in which different part like wall, PCC, RCC, soling and natural ground sub soil or sub grade soil. This all components are design or constructions per specification and required.

- **Super structure**

It is part of a building which is above the ground level and it serves the purpose of

use. The super structure has masonry work, beam, pillar, roof structure, floor structure, door, window, staircase or finished work.

i. Masonry Work

It is defined as the construction of the building. It is the boundary of the building. It make the partition of the building or divides the room in the different part of the area. Its main purpose is to separate the area for the different purposed inside the building. It is the essential part or component of the building and its primary function is to enclose and to make function able and useful.

ii. Column/Pillar

It is an essential part of the building. It is an isolated vertical load bearing member and having length, breadth and height as per design or required. It is the vertical component so that it takes all the load of the sub-structure. So, generally column or pillars are more stronger than other structure.

iii. Beam

It is an also calculated horizontal tensile load bearing member having length, breadth and span as per required or as per design. It is horizontal component so that its main purpose is to support the wall, slab or other any component of building on slab and it transferred its own weight or load and other all load above it to the pillar.

iv. Floor structure

Floors are the horizontal element which divides the building into different level. Its main purpose is to create the open surface or accumulation for the different use on it. It has length breadth and thickness as per required or design. In the building floor works is of any material or any types.

v. Roof structure

A roof is the uppermost part of the building. It is covering provided on the top of building with a view to keep out rain, snow, sunlight, wind etc and to protect the building from their adverse affect. The roof are of different design such slope, flat and of different material.

vi. Door

A door is a framework of wood, steel, aluminum fixed in the wall opening for the purpose of providing access to user of the building.

vii. Window

It is also an opening made in the wall and fixed on it for the purpose of providing day light, wind or ventilation and for vision purpose.

viii. Stair case:-

It is defined as a series of step which are suitably arranged for the purposed to connect different floor of the building. It provides an easy safe and quick access to the user in the different floor to floor.

ix. Building finish

They are used to give protective coveting to various building component at a same time. They provide decorative effect.

1.4 Terminology used in drawing, Components/elements of building

Components/elements of building:

Components part of building (Same as types of building structures)

- **Sub-structure**

It is the lower portion of the building usually located below the ground level which transmit the load of the super structure to the supporting soil. Its basic function is to transmit the dead load, live load and other load to the sub-soil or sub grade soil. In the sub-structure it consists mainly footing. This is the lowest part of the building or any construction work in which different part like wall, PCC, RCC, soling and natural ground sub soil or sub grade soil. This all components are design or constructions per specification and required.

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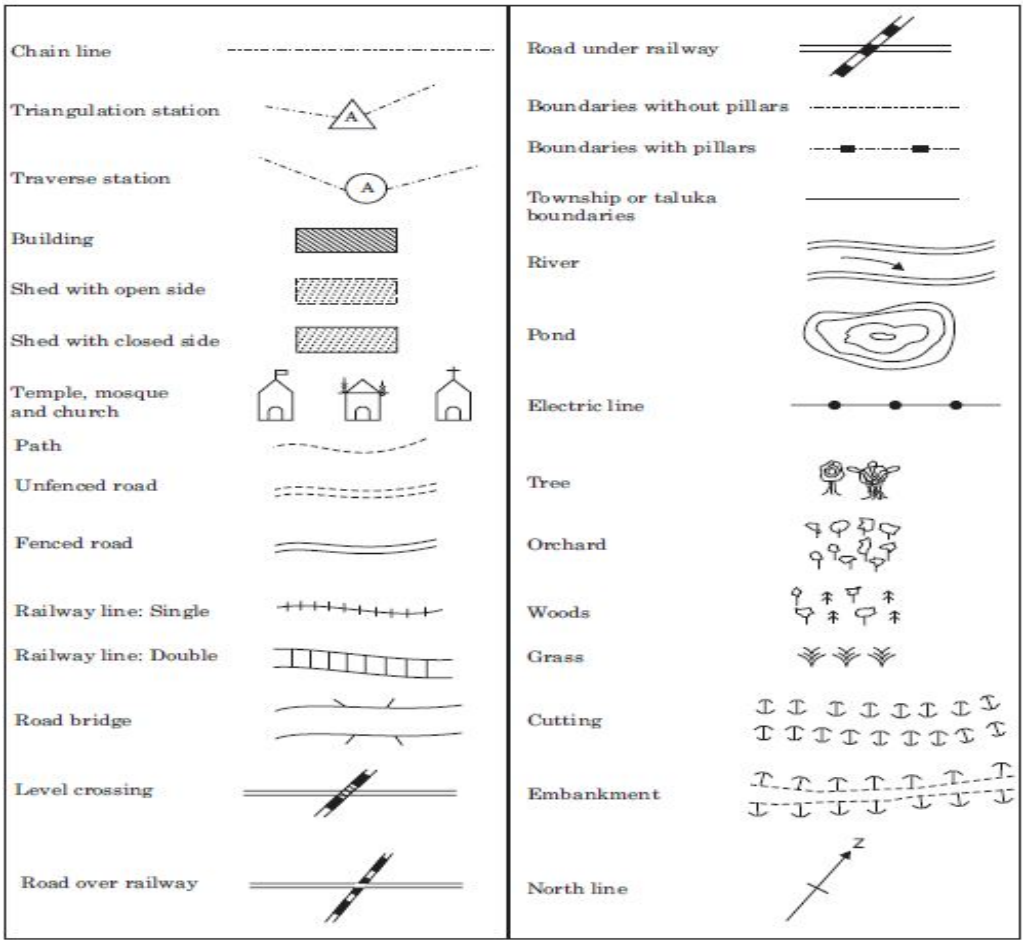
1.5 Engineering symbols and conventional signs



1.6 Introduction to by-laws and codes

A by-law and code is a rule or law established by an organization or community to regulate itself, as allowed or provided for by some higher authority. The higher authority, generally a legislature or some other governmental body, establishes the degree of control that the by-laws may exercise. By-laws may be established by entities such as a business corporation, a neighborhood association, or depending on the jurisdiction, a municipality.

By laws and codes is the strict rule which must be obeyed by everyone. If everyone makes building without obeying any rules then there will be problems of:

- Irregular and narrow roads
- Frequent traffic

- Problem of parking
- Health problems due to pollution
- Poor light and ventilation
- No proper planning of gardens, plat ground etc.
- Problems regarding services like water supply, drainage, telephone, gas, electricity etc.
- Noise nuisance in education, hospitals, court etc.

3. Teaching learning process and support materials

In course of facilitation of this unit, a teacher can make use of various teaching methods techniques and strategies suitable to the subject content and classroom context. Primarily the following methods and strategies can be used :

- Lecture
- Group Discussion
- Audio visual

Similarly with nregard to support materials, the teacher can use this resource materials and other relevant materials as per students' needs, relevance and their level.

Glossary

Occupant- the owner or tenant of a property

Weathering- mechanical or chemical breaking down of rocks in situ by weather or other causes

Reference

Luzadder, W.J., Fundamental of Engineering Drawing, Prentice-Hall of IndiaPvt-Ltd., New Delhi, Latest edition.

Bhatt N. D. and PanchalV.M., Engineering Drawing, Charotar Publishing House, 2001.

Gill P.S, Engineering Drawing, S. K. Kataraia& Sons, New Delhi, 2004/2005

Unit: 2

Basic drawing/drafting concept

1. Objective

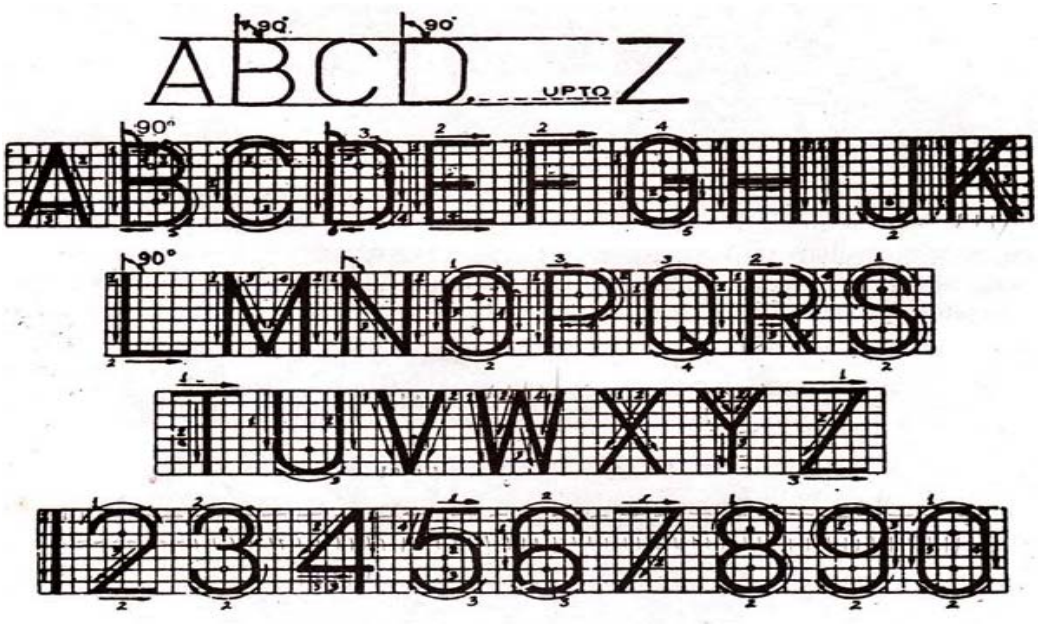
- To identify the drawing symbols
- To describe the detailed architectural drawing
- To prepare a plan
- To understand the section of the drawing

2. Content

2.1 Architectural Drafting-Lettering, Dimensioning lines, Title blocks, Office standards

Architectural Drafting-Lettering

Architectural drafting lettering is expected as a designer or architect that all blueprints, drawings and designs have architectural lettering.



Dimensioning lines

The dimension line is a thin line, broken in the middle to allow the placement of

the dimension value, with arrowheads at each end (see diagram below). An arrowhead is approximately 3 mm long and 1mm wide. That is, the length is roughly three times the width.

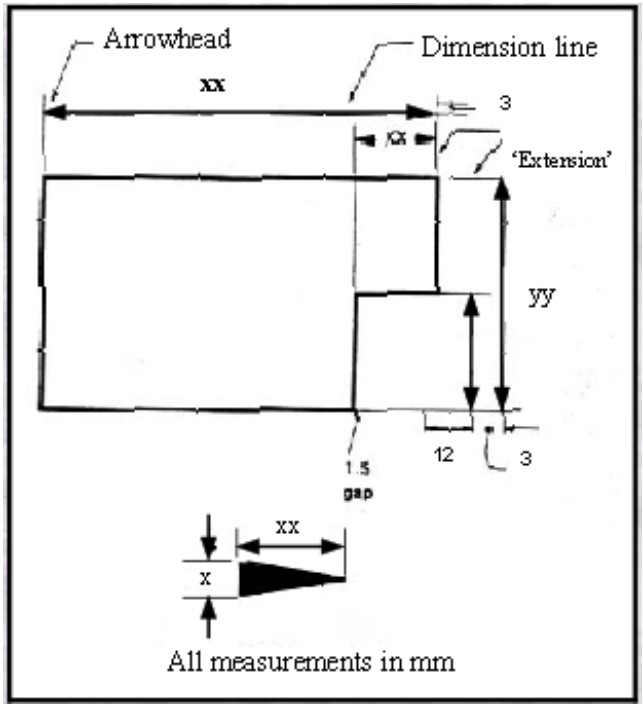
The purpose of dimensioning is to provide a clear and complete description of an object. A complete set of dimensions will permit only one interpretation needed to construct the part. Dimensioning should follow these guidelines :

Accuracy: Correct values must be given.

Clearness: Dimensions must be placed in appropriate positions.

Completeness: Nothing must be left out, and nothing duplicated.

Readability: The appropriate line quality must be used for legibility.



An extension line extends a line on the object to the dimension line. The first dimension line should be approximately 12 mm (0.6 in) from the object. Extension lines begin 1.5 mm from the object and extend 3 mm from the last dimension line. A leader is a thin line used to connect a dimension with a particular area (see the hole diameter arrow shown) A leader may also be used to indicate a note or

comment about a specific area.

When there is limited space, a heavy black dot may be substituted for the arrows, again clarity is the rule - it should be a clear point into which the dimension lines ends.

Also in this drawing, shown, two holes on the main surface of the flat panel are identical, allowing the "2x" notation to be used and the dimension to point to only one of the circles. This is more preferable than cluttering the space with duplicate information.

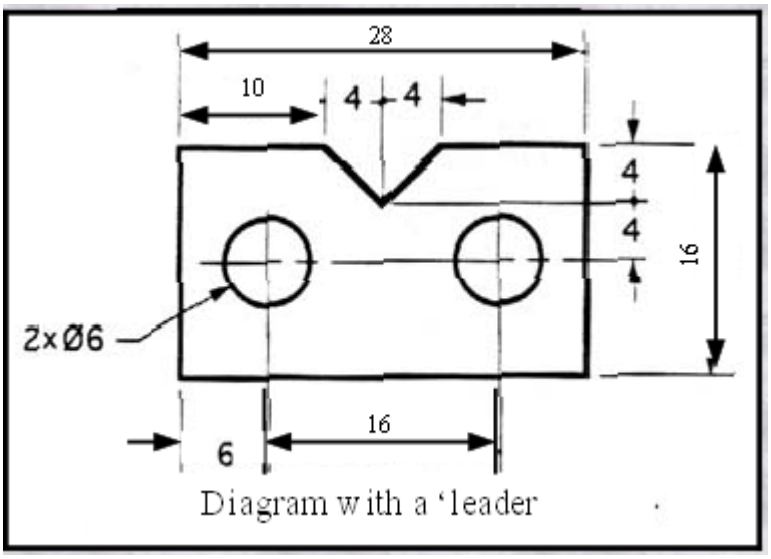


Diagram with a 'leader

Title blocks

A title block is comprised of the information boxes found on the bottom right- hand corner of a drawing, which indicate drawing details such as the title, author name, scale, and date the drawing was created. This is an introductory activity designed to be completed prior to any other board drawing activities.

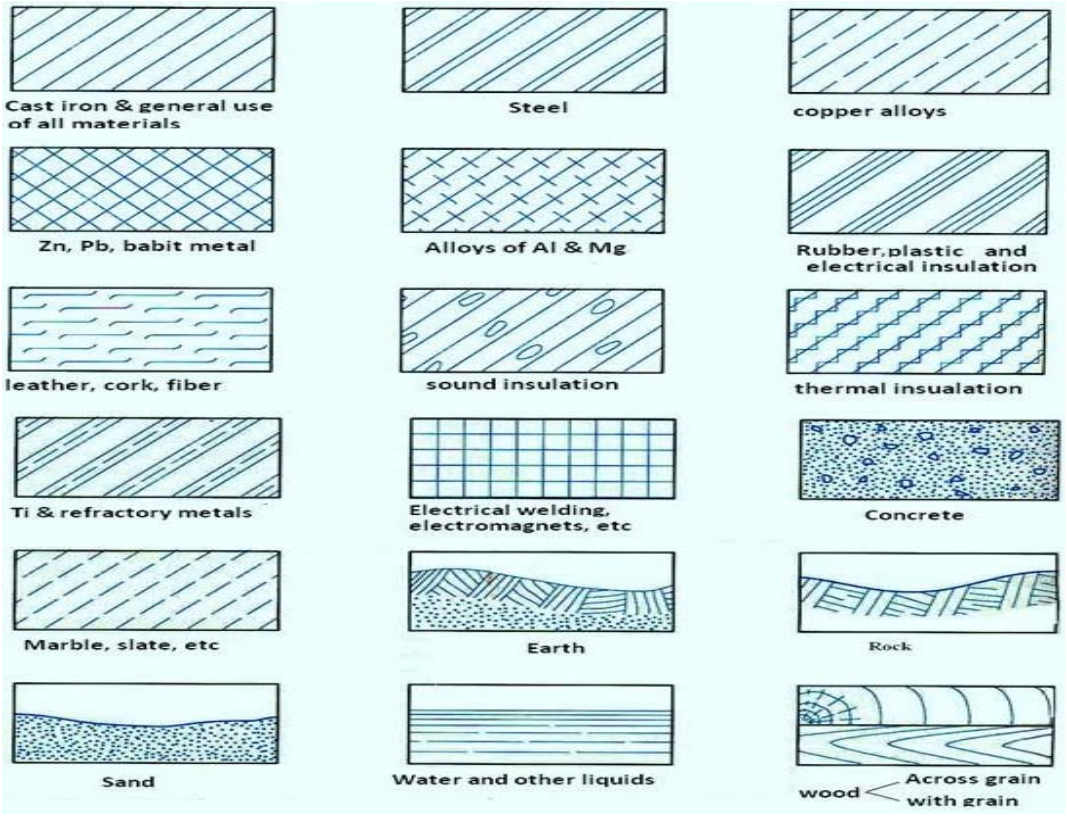
Office standards (Official used)

In engineering drawing there is a portion in the drawing which is used for the official used or concerned authority uses where they gives authorized approval to the drawings.

2.2 Drafting conventions, Representation of different materials in section, Graphic symbols

Material Symbols

The type of section line used to represent a surface varies according to the type of material. Symbols generally used for various materials are shown in figure 15. However, the general purpose section line symbol used in most section view drawings is that of *cast iron.* The specific type of steel to be used will be indicated in the title block or parts list. Occasionally, with assembly section views, material symbols are used to identify different parts of the assembly.



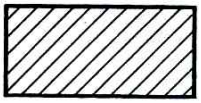
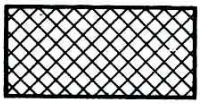
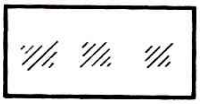
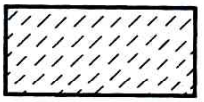
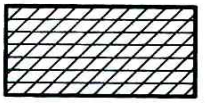
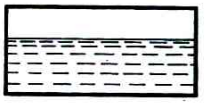
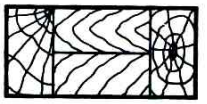
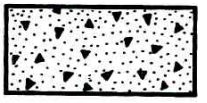
TYPE	CONVENTION	MATERIALS
METALS		STEEL, CAST IRON, COPPER AND ITS ALLOYS, ALUMINIUM AND ITS ALLOYS, ETC
		LEAD, ZINC, TIN, WHITE-METAL, ETC
GLASS		GLASS
PACKING AND INSULATING MATERIALS		PORCELAIN, STONEWARE, MARBLE, SLATE, ETC
		ASBESTOS, FIBRE, FELT, SYNTHETIC RESIN PRODUCTS, PAPER, CORK, LINOLEUM, RUBBER, LEATHER, WAX, INSULATING & FILLING MATERIALS
LIQUIDS		WATER, OIL, PETROL, KEROSENE, ETC
WOOD		WOOD, PLYWOOD, ETC
CONCRETE		

Figure 15. General symbols used to represent various materials in section view.

2.3 Drafting and preparing foundation plans

A foundation plan is a top view of the footings or foundation walls, showing their area and their location by distances between centerlines and by distances from reference lines or boundary lines. Actually, it is a horizontal section view cut

through the walls of the foundation showing beams, girders, piers or columns, and openings, along with dimension sand internal composition.

Here are step-by-step instructions for drawing the foundation measurements of a sample building:

1. Draw a solid line representing the outside dimensions of the walls of the building, this line will also represent the outside dimensions of the foundation wall.

Outside wall

2. Draw a second solid line inside the first one to represent the inside dimensions of the building's walls. This line will also represent the inside dimensions of the foundation wall. The space between the two lines should be exactly the width of the planned walls to scale.

The space between the two lines

3. Subtract the width of the wall from the planned width of the foundation footing. Divide the remainder in two and convert the answer into the scale dimension being used in the drawing. This figure represents the distance between the inner side of the wall and the inner side of the foundation footing.
4. Draw a dotted line inside the drawing of the walls. This line represents the inner dimension of the footing. The space between it and the inside solid line (step #2) should be exactly the distance calculated in step #3.

Inside edge of footing

5. Draw a dotted line outside the drawing of the walls. This line represents the outer dimension of the footing. The space between it and the outside solid line (step #1) should be exactly the distance calculated in step #3.

With of footing

6. On either side of the drawing's length, add a solid line exactly as long as the longest wall (that is, the longest outer solid line).
7. On either side of the drawing's width, add a solid line exactly as long as the longest wall (that is, the longest outer solid line).

Length and weight

8. Place a mark along each line from steps #6-7 wherever the outer wall turns a corner. Indicate the actual length of each straight section of wall.

Place a mark along each line

9. Outside the lines drawn in steps #6-7, draw two more solid lines exactly as long as the length and width of the outer dotted line. Mark these lines to indicate the actual length of each straight section of foundation footing.
10. Underneath the completed drawing, write down what the footing and foundation wall will be made of and their cross-section dimensions.
11. The completed drawing is an actual scale drawing showing the trenches that must be dug for the footing and the dimensions of the foundation walls.

2.4 Floor plans

In architecture drawing and building engineering, a floor plan is a drawing to scale, showing a view from above, the relationships between rooms, spaces, traffic patterns, and other physical features at one level of a structure.

Dimensions are usually drawn between the walls to specify room sizes and wall lengths. Floor plans may also include details of fixtures like sinks, water heaters, furnaces, etc. Floor plans may include notes for construction to specify finishes, construction methods, or symbols for electrical items.

2.5 Exterior elevations

An exterior elevation is a view of a building seen from one side, a flat representation of one façe. This is the most common view used to describe the external appearance of a building. Each elevation is labeled in relation to the compass direction it faces, e.g. looking toward the north you would be seeing the southern elevation of the building. Buildings are rarely a simple rectangular shape in plan, so a typical elevation may show all the parts of the building that are seen from a particular direction.

2.6 Sections

A cross section, also simply called a section, represents a vertical plane cut through

the object, in the same way as a floor plan is a horizontal section viewed from the top. In the section view, everything cut by the section plane is shown as a bold line, often with a solid fill to show objects that are cut through, and anything seen beyond generally shown in a thinner line. Sections are used to describe the relationship between different levels of a building. In the Observatorium drawing illustrated here, the section shows the dome which can be seen from the outside, a second dome that can only be seen inside the building, and the way the space between the two accommodates a large astronomical telescope: relationships that would be difficult to understand from plans alone.

Teaching learning process and support materials

In course of facilitation of this unit, a teacher can make use of various teaching methods techniques and strategies suitable to the subject content and classroom context. Primarily the following methods and strategies can be used :

- Lecture
- Group Discussion
- Audio visual

Similarly with nregard to support materials, the teacher can use this resource materials and other relevant materials as per students' needs, relevance and their level.

Glossary

Luzadder, W.J., Fundamental of Engineering Drawing, Prentice-Hall of IndiaPvt-Ltd., New Delhi, Latest edition.

Bhatt N. D. and PanchalV.M., Engineering Drawing, Charotar Publishing House, 2001.

Gill P.S, Engineering Drawing, S. K. Kataraia& Sons, New Delhi, 2004/2005

Unit: 3

Introduction to AutoCAD

1. Objective:

- to overview of AutoCAD
- to explain history of AutoCAD
- to differenciate the hardware and software
- to drawing
- to open a drawing in Autocad

2. Content

3.1 Overview of AutoCAD release

AutoCAD is a commercial computer-aided design (CAD) and drafting software application. Developed and marketed by Autodesk, AutoCAD was first released in December 1982 as a desktop app running on microcomputers with internal graphics controllers. Before AutoCAD was introduced, most commercial CAD programs ran on mainframe computers or minicomputers, with each CAD operator (user) working at a separate graphics terminal. Since 2010, AutoCAD was released as a mobile- and web app as well, marketed as AutoCAD 360.

AutoCAD software main aims to assist the reader to use AutoCAD 2007 with a series of interactive exercise. This exercise will be backed up with activities, thus allowing the reader to practice the new skills being demonstrated.

The **software** is developed by the Autodesk and it will support both 2D and 3D formats.

History of AutoCAD

AutoCAD= Automatic Computer Aided Design

Version 1.0 (Release 1) – Dec 1982

Version 1.2 (Release 2) – April 1983

Version 1.3 (Release 3) – Aug 1983

Version 1.4 (Release 4) – Oct 1983

Version 2.0 (Release 5) – Oct 1984

Version 2.1 (Release 6) – May 1985

Version 2.5 (Release 7) – Jun 1986

Version 2.6 (Release 8) – April 1987

Release 9 – sep 1987

Release 10 – Oct 1988

Release 11 – Oct 1990

Release 12 – Jun 1992 (Last Release for Apple Macintosh)

Release 13 – Nov 1994 (Last Release for unix, MS-DOS and Windows 3.11

Release 14 – Feb 1997

AutoCAD 2000 (R15.0) – Mar 1999

AutoCAD 2000i (R15.1)-jul 2000

AutoCAD 2002 (R15.6) – june 2001

AutoCAD 2004 (R15.6) – Mar 2003

AutoCAD 2005 (R16.0) – Mar 2004

AutoCAD 2006 (R16.1) – Mar 2005

AutoCAD 2007 (R16.2) – Mar 2006

AutoCAD 2008 (R17.0) – Mar 2007

AutoCAD 2009 (R17.2) – Mar 2008

AutoCAD 2010 (R18.0) – Mar 2009

AutoCAD 2011 (R18.1) – Mar 2010

AutoCAD 2012 (R18.2) – Mar 2011

AutoCAD 2013 (R19.0) – Mar 2012

AutoCAD 2014 (R19.1) – Mar 2013

AutoCAD 2015 (R20.0) – Mar 2014

AutoCAD 2016 (R20.1) – Mar 2015

AutoCAD 2017 (R21.0) – Mar 2016

AutoCAD 2018 (R22.0) – Mar 2017

AutoCAD 2019 (R23.0) – Mar 2018

3.2 Overview about fundamental of computer (hardware / software)

Hardware

Hardware is the physical component that we can actually touch and feel like disk, display screen, keyboard, printers etc. The display and storage device are also called hardware devices.

Software

It is untouchable. It exist as ideas, concepts and symbols but it has no body. A computer without software is like a book full of blank page. It is collection of instructions. Examples of software are Ms-word, AutoCAD, Power Point, etc.

3.3 Characteristics of AutoCAD

AutoCAD is the use of computer system to assist in the certain modification or analysis of a design. AutoCAD software is used to increase the productivity of design or improve the quality of design, improves communication through the documentation and to create a data base for manufacturing. AutoCAD output is often in the form of electronic files for printing. It is used in many fields for creating a technical drawing.

3.4 Benefits of AutoCAD

- Improve productivity in drafting
- Shorter preparation time for drawing
- Reduced manpower requirements
- Customer modification in drawings are easier
- Low wastage in drawing
- Improve drawing accuracy
- Develop better design
- Editing is possible
- Production of orthographic projection with dimension and tolerance
- Hatching of different sections with various patterns are possible

3.5 Overview about Peripheral devices

Auxiliary devices (equipment) used in computer (keyboard, mouse, scanner, etc.),

output (printer, plotter, speaker etc.) storage (floppy disk, pen drive, CD drive etc.), communication (microphone, modem, router etc.) or other function under a direct control of computer are known as peripheral devices.

Printer and Plotter

Printer

Printer an external hardware output device that take an electronic data stored on a computer or other devices and generate a hardcopy of text. Printers are most popular computer peripheral device and are commonly used to print the text and graphics. There are two types of printers they are

1. Impact printer
2. Non-impact printer

Plotter

Plotter is a computer hardware device much like a printer that is used for printing vector graphics. Plotter is widely used for plotting the drawings on AutoCAD. A plotter gives a hardcopy of the output. It draws picture on a paper using a pen. Plotters are used to print design of machine, plan for building etc. There are two types of plotter, they are

i. Drum plotter
ii. Electro static plotter

3. Teaching learning process and support materials

In course of facilitation of this unit, a teacher can make use of various teaching methods techniques and strategies suitable to the subject content and classroom context. Primarily the following methods and strategies can be used :

- Lecture
- Group Discussion
- Audio visual

Similarly with nregard to support materials, the teacher can use this resource materials and other relevant materials as per students' needs, relevance and their level.

Glossary

Hardware : Computer hardware is the collection of physical parts of a computer system. This includes the computercase, monitor, keyboard, and mouse. It also includes all the parts inside the computer case, such as the hard disk drive, motherboard, video card, and many others. Computer hardware is what you can physically touch.

Reference

Luzadder, W.J., Fundamental of Engineering Drawing, Prentice-Hall of IndiaPvt-Ltd., New Delhi, Latest edition.

Bhatt N. D. and PanchalV.M., Engineering Drawing, Charotar Publishing House, 2001.

Gill P.S, Engineering Drawing, S. K. Kataraia& Sons, New Delhi, 2004/2005

Unit: 4

Starting a new drawing/opening an existing drawing

1. Objectives

- to start a new drawing
- to open an existing drawing

2. Contents

4.1 Setting up a drawing starting from scratch, using a Wizard, using and creating a template file, drafting aids.

4.2 Opening an existing drawing

4.3 Screen layout, pull-down menus, screen icons, command line and dialogue boxes, status bar toggles

4.4 Setting preferences (Setting Units and Scale, managing drawing area by using MV setup and Limits.)

3. Teaching learning process and support materials

In course of facilitation of this unit, a teacher can make use of various teaching methods techniques and strategies suitable to the subject content and classroom context. Primarily the following methods and strategies can be used :

- Lecture
- Group Discussion
- Audio visual

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Unit: 5

Drawing commands

1. Objectives

- To be familiar with the different commands
- To prepare the dimension setup
- To make new drawing and modify the drawing by using the modify command

2. Content

Drawing command

The commands on Auto CADD (Automatic Computer Added Design and Drafting) that are used for drawing any objects, shapes, building etc. in new work space command. The examples of drawing commands area :

i. Line (L enter)
ii. Circle (C enter)
iii. Arc (A enter)
iv. Polyline (Pl enter)
v. Polygon (Pol enter)
vi. Rectangle (Rec enter)

5.1 Co-ordinate Input methods

i) Absolute co-ordinate system :

Syntax : x, y

Use absolute co-ordinate system when you know the precise x and y values of the location of the point from the origin.

Here,

Example:

Command: L enter

Line specify first point: 10, 10 enter

Specify next point: 10, 60 enter

Specify next point: 60, 60 enter

Specify next point: 60, 110 enter

Specify next point: 110, 110 enter

Specify next point: 110, 10 enter

Specify next point: 10, 10 enter or C enter

Specify next point: <ENTER>

ii) Relative Co-ordinate system :

Syntax: @ x, y

Use relative co-ordinate system when we know the precise x and y values of the location of a point in relation to the previous point.

1st point is always identified by absolute co-ordinate system.

Here,

Command = L enter

LINE specify first point: 10, 20 enter

Specify next point: @ 50, 0 enter

Specify next point: @ 0, 40 enter

Specify next point: @ -50, 0 enter

Specify next point: @ 0, -40 enter or C enter

Specify next point: <ENTER>

iii) Polar Co-ordinate System:

Syntax = @ distance (x) < Angle (ɵ)

Use polar co-ordinate system when we know the distance and an angle of a location of a point with reference to a previous point. 1St point is always identified by absolute co-ordinate system.

Here,

Command = L enter

LINE specify first point: 10, 20 enter

Specify next point: @ 50 < 0 enter

Specify next point: @ 40 < 90 enter

Specify next point: @ 50 < 180 enter

Specify next point: @ 40 < 270 enter or C enter

Specify next point: <ENTER>

Drawing commands

Construction line = XL Enter or enter

Line = L enter

Polyline = PL enter

Polygon = POL enter

Rectangle = REC enter

Arc = A enter

Circle = C enter

Revision cloud = REVCLOUD enter

Spline = SPL enter

Ellipse = EL enter

Point = PO enter

Hatch = H enter

Gradient = GD enter

Modify Commands

Erase = E enter

Copy = CO or CP enter

Mirror = MI enter

Offset = O enter

Array = AR enter

Move = M enter

Rotate = RO enter

Scale = SC enter

Stretch = S enter

Trim = TR enter

Extend = EX enter

Break = BR enter

Chamfer = CHA enter

Join = J enter

Fillet = F enter

Lengthen = LEN enter

Explode = X enter

5.2 Point, Line, Polyline, Multiline, Construction line

1. Point

This command is used to draw the point of different types.

Command: Po enter

To change the point types,

Command = DD P TYPE enter

2. Line

This command is used to draw the line of certain dimension. 'ORTHO' made should be 'ON' to draw the line either horizontal or vertical, show the direction and enter dimension value.

Command: L enter

3. Polyline

This command is similar to the line but doesn't break at all vertices and the

number of segments of lines act as a single line.

Command: PL enter

4. Multiline

This command is used to draw parallel line simultaneously.

Command: ML enter

5. Construction line

This command creates a line of infinite length. This line is mostly used for making elevation.

Command: XL enter

For Horizontal: H enter

For Vertical: V enter

For inclined (angular): A enter

5.3 Circle, Arc, Ellipse, Donut

1. This command is used to draw the circle with given radius, diameter, two points, three points, etc.
   Command: C enter

2. Arc

This command is used to draw an arc (of a circle). Minimum three points is required to draw an arc.

Command: A enter

3. Ellipse

This command is used to draw an elliptical object with given major and minor axis.

Command: EL enter

4. Donut

This command is used to draw the cross – section of rod, pipe, etc.

Command = Do enter

5.4 Polygon, Rectangle, Spline, Solid, etc.

1. Polygon

This command is used to draw regular polygon, such as square, pentagon, hexagon etc.

Command: - POL enter

RI = Inscribe in circle = Radius = Center to

Rc = Circumscribed about circle = Radius = midpoint

2. Rectangle

This command is used to draw rectangle in any size. The command is mostly used (to draw) for making column in building plan.

Command: - REC enter

3. Spline

This command is used to draw non – uniform curves.

Command: - SPL enter

4. Solid

This command creates a solid hatch with in a selected closed boundary. (Minimum number of points for solids is 4).

Command: - So enter

5.5 Hatching and Gradient

Hatch are representatively pattern of lines that fill in an area. Most type of drafting makes use of hatching.

Command: - H enter

1. Hatch and gradient dialog box is approved.
2. Choose the desired hatch pattern.
3. Click on add pick point or select object.
4. Pick internal point of object or select the required object.
5. Click on preview. If hatch is right click accept otherwise click on modify.

6. Then change the scale and angle and click on ok.

Gradient are the representing pattern of colors. It is mainly used for window in building elevation.

Command: - GD<Enter>

1. Choose the desired gradient color.
2. Click on add pick point.
3. Pick internal point or (select objects / remove boundaries): <pick inside region
4. Click on OK.

5.6 Text (multi-line and single line / true type fonts)

Every drawing includes text that explains the object in the drawing. You can easily format and edit text to provide a professional appearance to your drawing.

The common text height for note is 1/8" to 1/12" or 2mm to 3mm.

There are two types of text setting: -

i. Single line text
ii. Multi line text

i. Single line text:

Command: - DT enter
Specify start point of text: - Click anywhere.
Specify height: Specify desired height of text.
Specify rotation angle of text: O enter
Write the required text.

ii. Multiline text:

Command: M TEXT enter
Specify first corner: click anywhere.
Specify opposite corner: click opposite corner.
Text formatting box is approved. You can manage the text style, text height, etc. in this box. Now you can write the required text.

Unit setup

The process of managing the drawing units in Auto CAD is called unit setup. You can set the desired unit with precision by using this command.

Command: - UN enter

Process

- Go format menu
- Click on units

  Or, Command: - UN enter

  Units dialog box is approved.

Length Type	Precision	Insertion scale
Decimal	0	Millimeter
Architectural	0’ – 01/8”	Inces
Engineering	0’ -0.0”	Inches

Select the desired unit type.

5.7 Dimension Setup

A dimension style is a collection of dimension setting that controls the appearance of dimension such as arrow head style, text height and text position and lateral tolerances.

Command: - D enter

- Dimension style manager dialogue box is approved.
- Click on New to create new dimension style.
- Enter name and click on continue.
- Manage desired lines, symbols and arrows, text, fit, primary units, alternate units and tolerances for a new dimension set up.
- Click on OK.
- Click on set current and close.

Numerical

Command: - L enter

Line specify first point = 5, 2 enter

Specify next point = @ 8 < 0 enter

Specify next point = @ 2 < 90 enter

Specify next point = @ 3 < 180 enter

Specify next point = @ 7 < 90 enter

Specify next point = @ 5 < 210 enter

Specify next point = @ 7 < 0 enter

Specify next point = < Enter >

Absolute System

Command: - L enter

Line specify first point = 5, 2 enter

Specify next point = 5, 9 enter

Specify next point = 10, 11 enter

Specify next point = 10, 4 enter

Specify next point = 13, 4 enter

Specify next point = 13, 12 enter

Specify next point = 5, 2 enter or C enter

Specify next point = < Enter >

In polar system:

Command: - L enter

Line specify first point = 10, 10 enter

Specify next point = @ 35.4 < 90 enter

Specify next point = @ 50 < 45 enter

Specify next point = @ 50 < 315 enter

Specify next point = @ 50 < 225 enter

Specify next point = C enter

Absolute co-ordinate system

Command: - L enter

Line specify first point = 10, 10 enter

Specify next point = 10, 45.4 enter

Specify next point = 60, 95.4 enter

Specify next point = 95.4, 60 enter

Specify next point = 45.4, 10 enter

Specify next point = C enter

Relative co-ordinate system

Command: - L enter

Line specify first point = 10, 10 enter

Specify next point = @ 0, 35.4 enter

Specify next point = @ 50, 50 enter

Specify next point = @ 50, 150 enter

Specify next point = @- 50, -50 enter

Specify next point = C enter

Absolute system

Command: - L enter

Line specify first point = 5, 2 enter

Specify next point = 5, 6 enter

Specify next point = 10, 11 enter

Specify next point = 15, 6 enter

Specify next point = 8, 2 enter

Specify next point = C enter or 5, 2 enter

Relative system

Command = L enter

Line specify first point = 5, 2 enter

Specify next point = @ 0, 4 enter

Specify next point = @ 5, 5 enter

Specify next point = @ 5, -5 enter

Specify next point = @- 7, -4 enter

Specify next point = @ - 3, 0 enter or C enter

<Enter>

3. Teaching learning process and support materials

In course of facilitation of this unit, a teacher can make use of various teaching methods techniques and strategies suitable to the subject content and classroom context. Primarily the following methods and strategies can be used :

- Lecture
- Group Discussion
- Audio visual

Similarly with nregard to support materials, the teacher can use this resource materials and other relevant materials as per students' needs, relevance and their level.

Glossary

Hatching: shading with closely drawn parallel lines.

Polygon: In elementary geometry, a polygon is a plane figure that is described by a finite number of straight line

Reference

Luzadder, W.J., Fundamental of Engineering Drawing, Prentice- Hall of IndiaPvt-Ltd., New Delhi, Latest edition.

Bhatt N. D. and PanchalV.M., Engineering Drawing, Charotar Publishing House, 2001.

Gill P.S, Engineering Drawing, S. K. Kataraia& Sons, New Delhi, 2004/2005

Unit: 6

Modify Commands

1. Objectives

- to be familar with the object selection methods
- to use the all modify commands

2.0 Contents

6.1 Object Selection Method

When modify command is entered in command prompt window the task to be done is followed by the word "SELECT OBJECT" prompt. To active the selection method enter keyboard is selecting object prompt. Object can be selected by different ways.

1. Pick box selection
2. Window selection (W)
3. Crossing window selection (C)
4. Window polygon selection (WP)
5. Crossing window polygon selection (CP)
6. Fence selection (F)
7. Last object selection (L)
8. Previous object selection (P)
9. Select all (All)

Pick box selection method

This method is simplest and mostly used object selection method. By using this method, individual object can be selected by clicking it.

Window selection

The window selection option invoked by typing 'W' at the select object prompt.

OR,

Movement: - Left to right

Shade: - Blue

Result: - All objects which lie entirely within the window (blue shade) will be selected.

Crossing Window Selection

The crossing window selection option invoked by typing select object prompt. OR,

Movement: - Right to left

Shade: - Green

Result: - All objects which lie entirely within the window (green shade) those which cross the window border will be selected.

Fence selection

The fence selection option invoked by typing 'F' at the select object prompt. Fence option allows us to draw a multi – segment line, like a polyline. All objects which cross the fence will be selected.

Window polygon selection

This option invoked by typing 'WP' at the select object prompt. The object which lie entirely within the window polygon will be selected and the object which lie partially with in the window polygon will not be selected.

Crossing window polygon selection

This option invoked by typing 'CP' at the select object prompt. The object which lie entirely within the window of those which cross the window, will be selected.

Last object selection

This option invoked by typing 'L' at the select object prompt. The lastly drawn object will be selected.

Previous object selection

This option invoke by typing 'P' at the select object prompt. By using this option, the object will be selected that was selected on previous selection.

Select all

This option invoked by typing 'all' at the select object prompt. The whole object within the working area will be selected. This option also can be done by: -

'Ctrl + A'

6.2 Erase, Trim, Break

Modify command

Modify commands are those commands of Auto CADD which are used for editing any objects on working area.

Modify commands can be used from pull – down modify menu, modify toolbar or directly entering shortcut command.

Erase

This command is used to remove undesirable object from drawing area.

Command: - E <enter>

Trim

This command is used to remove/cut the object from its cutting edge.

Command: - TR <enter><enter>

Note:

- Single object cannot be trim.
- Object fixed at one or two end, this object also can't be trim.

Break

This command is used to remove certain portion of object with is given two or one point.

Command: - BR <enter>

6.3 Copy, Mirror, Offset, Array

Copy

This command is used to make one or more duplicates of original object.

Command: - CO <enter> / CP enter

Mirror

This command is used to copy of mirrored objects (to make mirror of an object with a respect to a mirror line).

Command: - Mi <enter>

Note: Erase source object = N enter

Offset

This command is used to make parallel line, arc or concentric circle.

Command: - O <enter>

Array

This command is used to make multiple copy in certain pattern.

Command: - AR <enter>

There are two types of array

i. Rectangular array
ii. Polar array

6.4. Move, Rotate, Scale, Stretch

Move

This command is used to displace the objects from its original position.

Command: - M <enter>

Rotate

This command is used to tilt the object by fixing its base point in any direction.

Command: - Ro <enter>

Scale

This command is used to increase or decrease the size of the object in multiplying factor.

Command: - SC <enter>

Stretch

This command is used to change the length or breadth of the portion of the object.

Command: - S <enter>

6.5 Lengthen, Extend

Lengthen

This command is used to increase or decrease the length of a line.

Command: - LEN <enter>

Extend

This command is used to prolong the linear line of its certain boundary. Object need boundary to extend.

Command: - Ex <enter><enter>

6.6 Chamfer, Fillet

Chamfer

It is used to make level shape with given dimension of cutting/trim edge.

Command: - CHA <enter>

Fillet

It is used to make rounded edge with given radius of cutting/trim edge.

Command: - F <enter>

3. Teaching learning process and support materials

In course of facilitation of this unit, a teacher can make use of various teaching methods techniques and strategies suitable to the subject content and classroom context. Primarily the following methods and strategies can be used :

- Lecture
- Group Discussion
- Audio visual

Similarly with nregard to support materials, the teacher can use this resource

materials and other relevant materials as per students' needs, relevance and their level.

Glossary

Erase : rub out or remove

Chamfer: (in carpentry) cut away (a right-angled edge or corner) to make a symmetrical sloping edge.

Reference

Luzadder, W.J., Fundamental of Engineering Drawing, Prentice-Hall of IndiaPvt-Ltd., New Delhi, Latest edition.

Bhatt N. D. and PanchalV.M., Engineering Drawing, Charotar Publishing House, 2001.

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Unit: 7

Features

1. Objective

- To be familiar with about different tools used in Autocad
- To understand the concept of layers
- To use the measure and divide features of Autocad
- To use about inquiry commands

2. Contents

7.1 View tools

To Display a Toolbar

- To display the menu, click Quick Access Toolbar drop-down > Show Menu Bar.
- To display a toolbar, click Tools menu > Toolbars and select the required toolbar.

7.2 Layers concept, match and change properties

Layer

Layers offer powerful features that enables you to show differences all the various elements of your drawing. In an architectural drawing, for example you will commonly create layer for wall, door, window, column, text etc.

When you do efficient work in AutoCAD, first of all you create layer, assign a layer name and change the properties of layer. Then you can draw object in this layer.

Properties of layer

- It manages the line type
- It manages the line weight
- It manages the line color
- It manages to separate different object
- It manages to lock the object

Creating new layer

- Click on the layer property manager on the layer tool bar. Or,
- Command: LA enter
- Layer property manager dialogue box is approved
- You can add necessary layer for your drawing by the following process:
  - Click on new layer button
  - Enter name for the layer
  - On the same line, as the new layer click on color and choose the required color
  - On the same line, click on the line type, choose the required line type
  - On the same line, as a new layer, click on line weight and choose the required line weight
  - All the layers are completed, then, click on apply and OK

7.3 Measure and divide

Measure

It creates point object or block at major interval along the length or perimeter of the object.

Command: - ME enter

Divide

To divide a line in any required segments.

Command: DIV enter

7.4 Inquiry command

i) Area

To find an area and perimeter of any selected object

Command: - AA enter (point selection method)

Specify first corner point or [object / Add / subtract]: -

<Pick corner> P1

Specify next corner point or press ENTER for total: -

<Pick corner> P2

Specify next corner point or press ENTER for total: -

<Pick corner> P3

Specify next corner point or press ENTER for total: -

<Pick corner> P4

Specify next corner point or press ENTER for total: -

<Pick corner> P5

Specify next corner point or press ENTER for total: -

<Pick corner> P6

Specify next corner point or press ENTER for total: -

<Pick corner> P1

Specify next corner point or press ENTER for total: -

<ENTER>

Now, area and perimeter of selected object will be displayed on command line.

Object selection method

Command: AA enter

Specify first corner point or [object/add/subtract]: O enter

Select Object: <select polyline object>

Now, area and perimeter of selected object will be displayed on command line.

ii. Distance

To know the distance between two points, angle in XY plane, angle from XY plane etc.

Command: DI enter

DIST specify first point: <click first point>

Specify second point: <click second point>

Now, distance, angle in XY plane and angle from XY plane will be displayed.

3. Teaching learning process and support materials

In course of facilitation of this unit, a teacher can make use of various teaching methods techniques and strategies suitable to the subject content and classroom context. Primarily the following methods and strategies can be used :

- Lecture
- Group Discussion
- Audio visual

Similarly with nregard to support materials, the teacher can use this resource materials and other relevant materials as per students' needs, relevance and their level.

Glossary

Layer : a layer is the term used to describe the different levels at which you can place an object or image file.

Reference

Luzadder, W.J., Fundamental of Engineering Drawing, Prentice-Hall of IndiaPvt-Ltd., New Delhi, Latest edition.

Bhatt N. D. and PanchalV.M., Engineering Drawing, Charotar Publishing House, 2001.

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