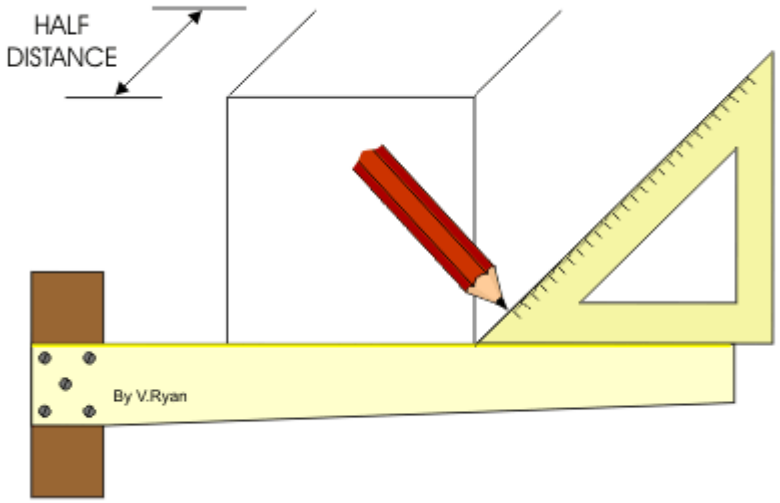
Building electrical instalation

Level-I

Based on June 2021, Curriculum Version 1



Module Title: - **Technical Drawings**

Module code: EIS BELI M05 0822

Nominal duration: 72Hour

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Acknowledgment

Ministry of Labor and Skills wish to extend thanks and appreciation to the many representatives of TVET instructors and respective industry experts who donated their time and expertise to the development of this Teaching, Training and Learning Materials (TTLM).

Introduction to the Module

Preparing technical drawing helps to know the Plan and prepare for installation, collate information for drawing in building electrical installation work filed

This module covers the knowledge, skills and attitude required to read and interpret plans and specifications and produce sketches, orthographic and sectional view drawings relevant to construction projects. For the unit of competency: Prepare technical drawing

This module covers the units:

- Collate information for drawing
- Create simple sketches, orthographic drawings and sectional views
- Develop specifications

Learning Objective of the Module

- Collate information for drawing
- Create simple sketches, orthographic drawings and sectional views and
- Develop specifications

Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the "LAP test" giver at the end of each unit and
5. Read the identified reference book for Examples and exercise

Unit one: collate information for drawings

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- OHS with basic building drawing
- quality requirement for building drawing
- tools & equipment selection for drawing
- Types of technical drawing
- Key features of technical drawing

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Associate OHS with basic building drawing
- Recognize and adhere quality requirement of the company operations
- List appropriate tools , equipment's ,Construction drawings and documents
- Identify Types of technical drawing
- Identify Key features of technical drawing, site dimensions and orientation, buildings, services and feature identification

1.1. OHS requirement for basic building drawing

1.1.1. Safety requirements

Safety in the workshops is subject to a number of various risk assessments and safe codes of working practices which have to be observed and adhered to by all workshop users and enforced by the person in charge of these areas. Due to high risk activities taking place in the workshops access to these areas is restricted to authorized personnel only. No other person may enter the workshops without permission.

OHS requirements are followed in accordance with safety plans and policies. Plant, tools and equipment selected to carry out tasks are consistent with the requirements of the job, checked for serviceability and any faults are rectified or reported prior to commencement.

Before start using of the following equipment and tools check;-

- Check the sharpness of Pencil.
- Check the condition of drawing board or drawing table
- Check and clean drawing templates
- Check the compass etc

1.1.2. Regulatory requirements

All work performed pursuant to specifications shall comply with the Requirements of the relevant local Acts, Regulations, Standards and Codes of Practice of all authorities having jurisdiction over the work.

The Building Regulations ~ this is a Statutory Instrument which sets out the minimum performance standards for the design and construction of buildings and where applicable to the extension of buildings. The regulations are supported by other documents which generally give guidance on how to achieve the required performance standards.

Deposit of Plans or Full Plans Application ~

• Application form describe the proposed work.

• Location plan, scale not less than 1: 2000.

• Block plan, scale not less than 1 : 200 showing north point, lines of drains (existing and proposed) and size and species of trees within 30 m.

• Plans, sections and elevations, scale not less than 1: 50 (1: 100 may be acceptable for elevations).

• Materials specification.

• Structural calculations where appropriate, e.g. Load bearing beams.

• Fee depending on a valuation of work.

The appointed inspector examines the application and subject to any necessary amendments, an approval is issued. This procedure ensures that work on site is conducted in accordance with the approved plans. Also, where the work is being financed by a loan, the lender will often insist the work is only to a Full Plans approval.

Building Notice ~

• A simplified application form.

• Block plan as described above.

• Construction details, materials specification and structural calculations if considered necessary by the inspector.

• Fee depending on a valuation of work.

This procedure is only really appropriate for minor work such as extensions to existing small buildings such as houses. Building control/inspection occurs as each element of the work proceeds. Any Building Regulation contravention will have to be removed or altered to attain an acceptable standard.

Regularization ~

• Application form.

• Structural calculations if relevant.

• A proportionally higher fee.

Technical data

The design drawings and technical specifications should include;-

• Design drawings: – these set out design information and Procedures which are required

To be used on the works.

• Bill of Quantities: – this itemizes the quantity of materials to enable a tender to

Accurately cost the work for which they are bidding.

• Material specifications; – such as diameter, type and grade of Material for pipes

(E.g. Polyethylene pipes or UPVC), joining Methods (e.g. Electro-fused Or compression fittings etc.), or 28-Day compressive strength of concrete.

Requirements for Material Testing;- e.g. Testing required for Earthworks (i.e. Minimum required compaction and moisture range To be achieved), frequency of testing (e.g. One soil density test per1,000 m3of bulk earthworks) or the number of tests per 1,000 m2 of area for hydraulic conductivity tests in sedimentation ponds.

1.1.3 Environmental protection

Is the practice of protecting the natural environment by individuals, organizations and governments?.

Its objectives are to conserve natural resources and the existing natural environment and, where possible, to repair damage and reverse trends. Environmental protection requirements are identified for the project in accordance with environmental plans and regulatory obligations and

applied tools and equipment selected to carry out tasks are consistent with the requirements of the job.

Environment = surroundings which can be natural, man-made or a combination of these.

Built Environment = created by man with or without the aid of the Natural environment.

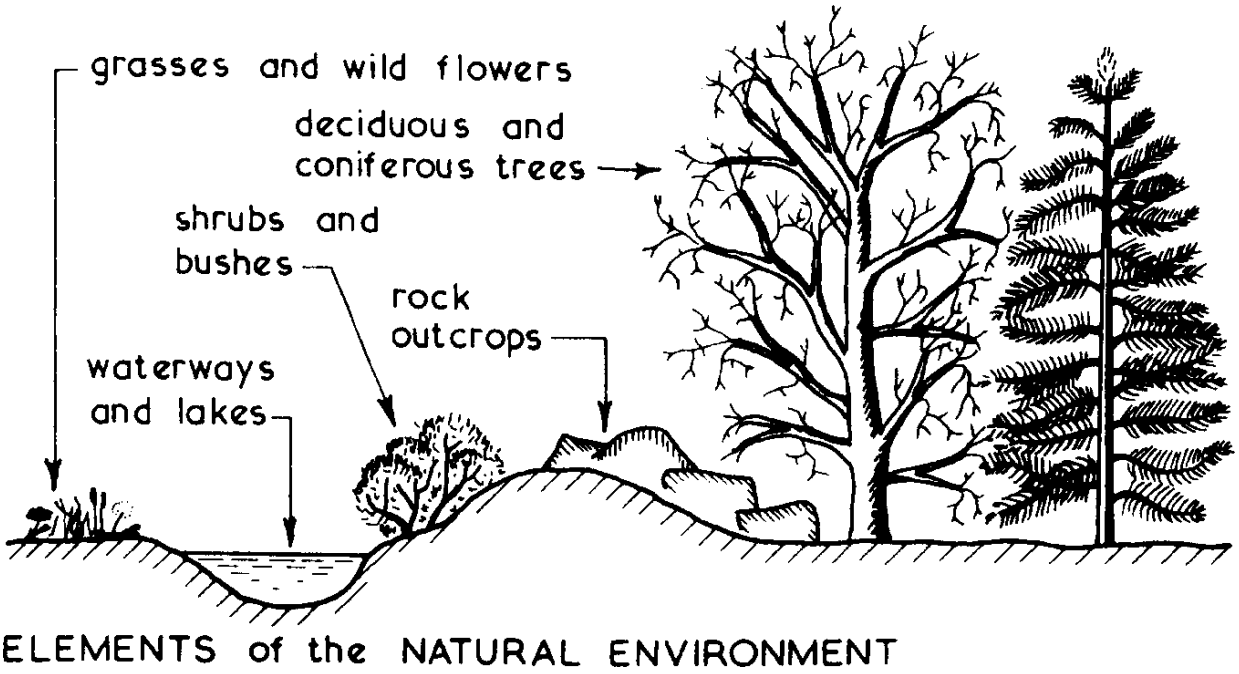
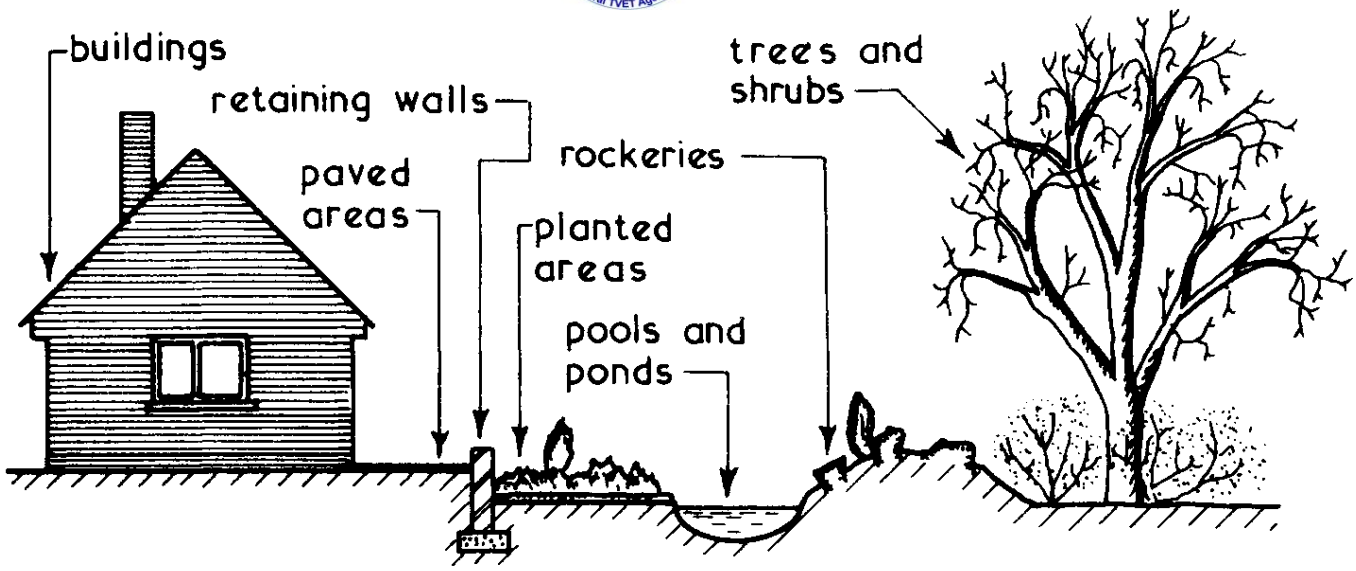
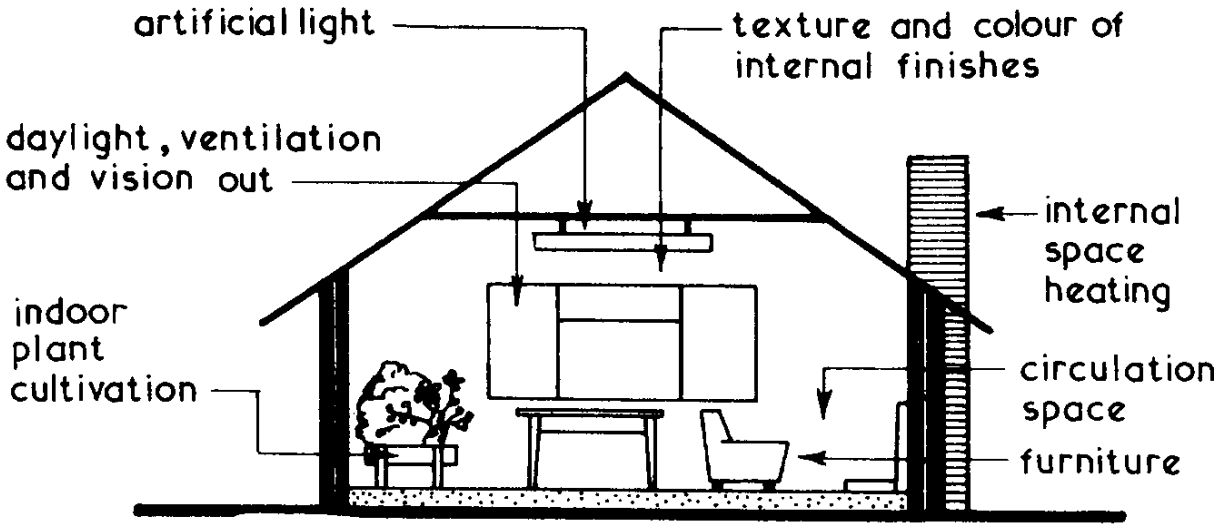


Fig 1.1 natural environment



ELEMENTS of the BUILT ENVIRONMENT (EXTERNAL)

fig 1.2 environment



ELEMENTS of the BUILT ENVIRONMENT (INTERNAL)

Fig 1.3

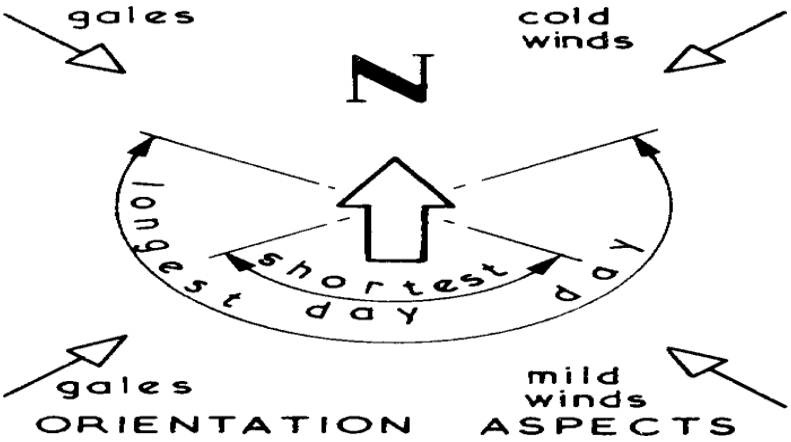


Fig 1.4 orientation aspects

Environmental Considerations

1. Planning requirements.
2. Building Regulations.
3. Land restrictions by vendor.
4. Availability of services.
5. Local amenities including transport.
6. Subsoil conditions.
7. Levels and topography of land.
8. Adjoining buildings or land.
9. Use of building.
10. Daylight and view aspects

1.2. Quality requirement for building

Quality requirement is a common term in project management. It is defined as the condition used to assess the conformance of the project by validating the acceptability of an attribute or characteristic for the quality of a particular result.

The quality requirement defines the expectations of the customer for quality, the internal processes as well as the attributes of products that indicate whether the quality factors are satisfied or not.

Quality requirements are specifications of the quality of products, services, processes or environments. Quality is any element, tangible or intangible, that gives things value beyond their functionality and features.

2.2.1 Types of drawing lines (Alphabet of Lines)

Each line on a drawing has a special meaning. In order to help make and read drawings, standard line symbols were developed. The line symbols in Fig. 2.1 are the actual thickness they should be on a finished drawing.

There are two thicknesses of lines: thick and thin.

The thick lines: are used for visible, cutting-plane, and short break lines.

The thin lines: are used for long break, hidden, center, section, extension, and dimension.

2.2.2 Object line (Visible lines)

Are used to show the main outline of a building and all interior walls. They are used for porches, patios, driveways, and construction details. All outlines of any major part which should stand out on the drawing should use a visible line.



2.2.2. Hidden line Hidden lines

Show edges and surfaces which are not visible to the eye but are hidden below a visible surface. They are made of short dashes about (3 mm) long. The spacing between dashes is about (1 mm).

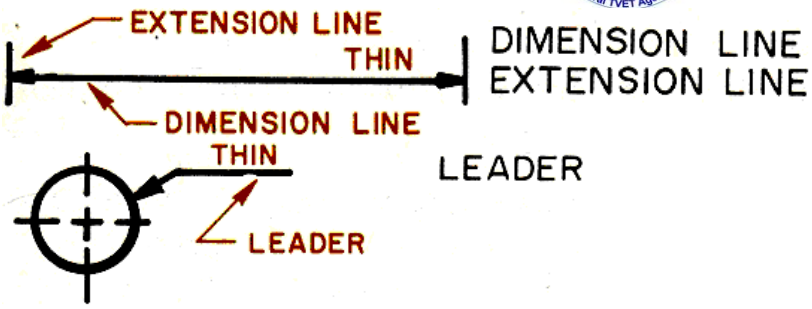


2.2.3. Dimension lines:

Are thin, solid lines. They are used to show the distance represented by a size dimension. They usually have arrowheads on each end.

2.2.4. Extension lines

Are thin, solid lines used with dimension lines. They extend to a point on a drawing to which the dimension line refers.



2.2.5. Center lines

Are thin lines used to locate the center of holes or cylindrical solids. They are made of long and short dashes. The long dashes can be from (19 mm) to (38 mm). The short dashes are about (1.6 mm) long.



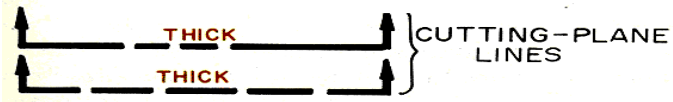
2.2.6. Section lines

Are used to show a surface that has been cut in a section view. They are thin lines drawn parallel and spaced (1.6 mm) to (3 mm) apart.



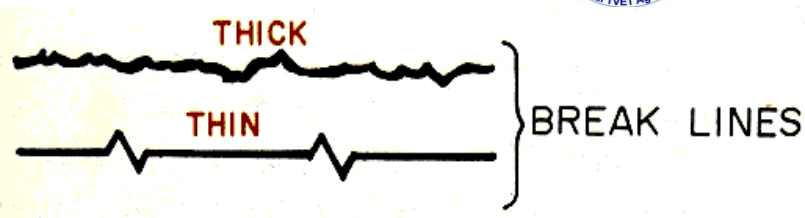
2.2.7 .Cutting-plane lines

Show where a section has been taken on a drawing. They are thick lines with arrows on the end to show the direction in which the section was taken. Two symbols are in use. One is a series of dashes of equal length and the other is a series of long and short dashes.



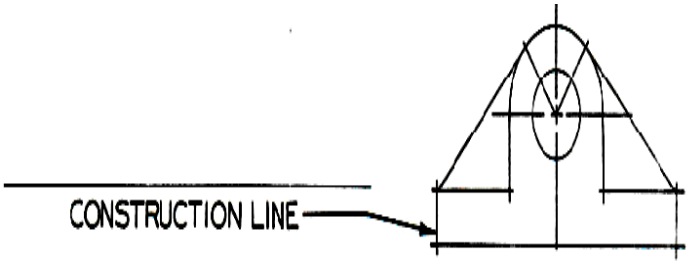
2.2.8. Break lines

Are used to show the edge where part of the drawing has been removed. Short breaks are made with a thick, freehand, jagged line. Long breaks are made with a thin, solid line with a z symbol located every several points..



2.2.9. Construction lines

Are thin lines which can easily erase after construction of the desired object.



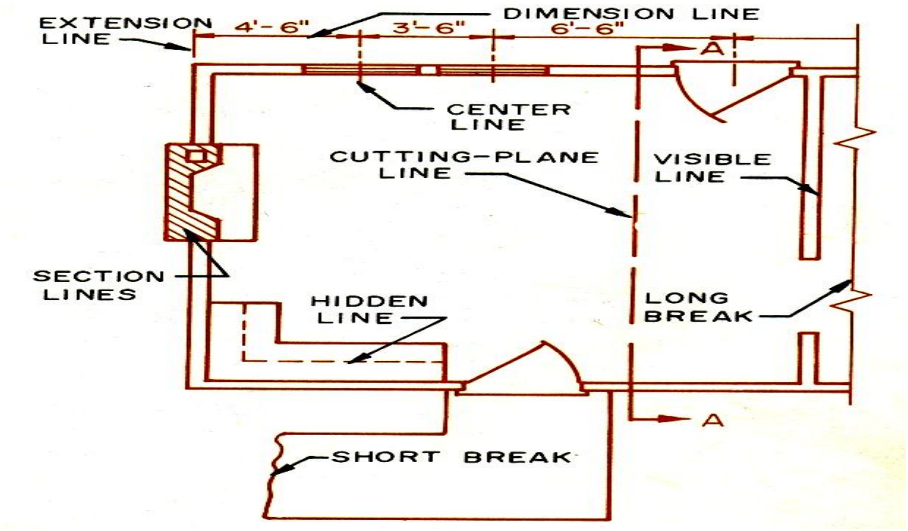


Fig 2.1 section line

1.3. Technical drawing tools and equipment

S Technical drawing instruments allow drafters to produce precise drawings. Technical drawing instruments are the tools used by professional and student drafters to render the precision graphics needed to manufacture a product or structure.

These instruments take many forms because of the variety of lines and graphics needed for designs. Some instruments are manual, while others are computer-based. All professional quality drafting instruments are manufactured with precision because the drawings they're used to make must be precise..

1.3.1 Basic Drawing Tools

T-Squares are use to draw horizontal lines. They are especially useful when constructing accurate orthographic drawings or architectural drawings. A T-Square is normally used with a drawing board, set squares and clips.

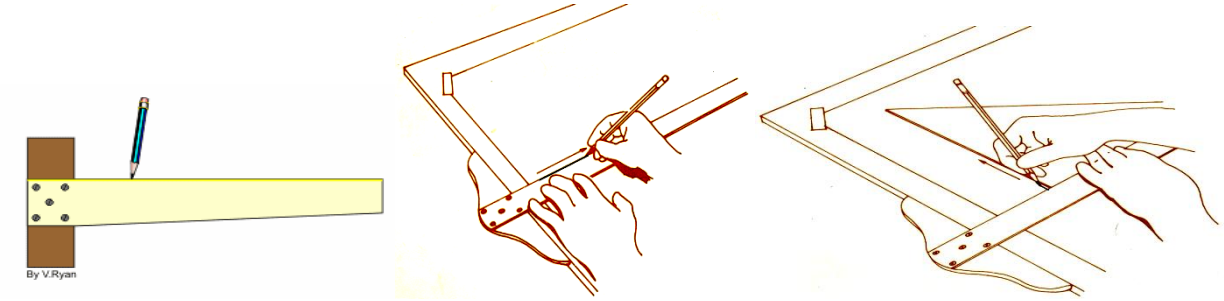


Fig 3.1 basic drawing

Set Squares are used to draw accurate angles. The most common are 45 and 60/30 degrees. When using set squares they should always used along with a T-Square.

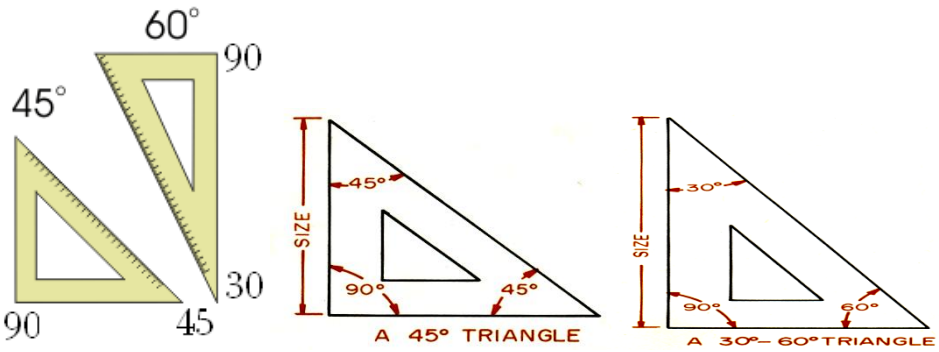


Fig 3.2 set square

A compass is an absolute essential piece of equipment. It includes at least two compasses allowing the drawing of small circles arcs and large circles arcs

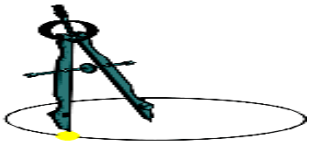


Fig 3.3 compass

Dividers are similar to the compass. The dividers, as the name implies, are used for dividing distances into a number of equal parts. They are also used for transferring distance or for setting off a series of equal distance.

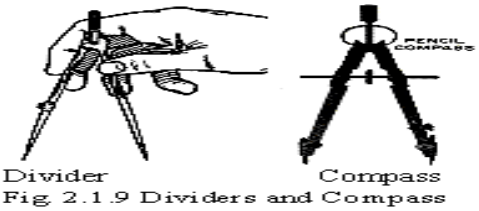


Fig 3.4 dividers

Engineering Scales are used only for measuring different scales.. It is important that drafters draw accurately to scale.

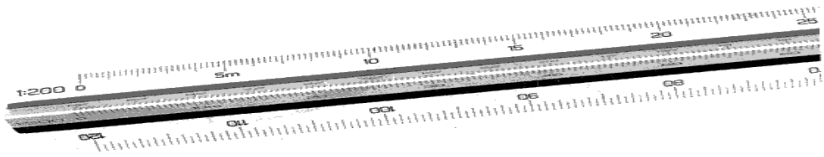


Fig 3.5 scale

A protractor is used to measure angles. A typical protractor is a semi-circular piece of plastic

With 180 degrees printed around its curve. This piece of equipment is not only used in

Graphics for constructing accurate drawings but is also used in subjects like Mathematics.

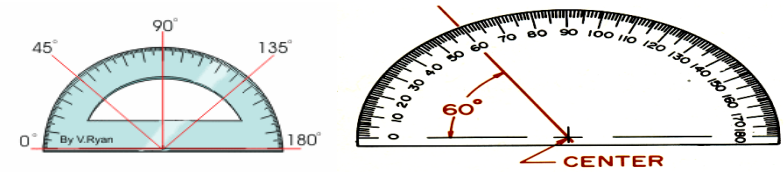


Fig 3.6 protractor

French curve is used to draw irregular curves.

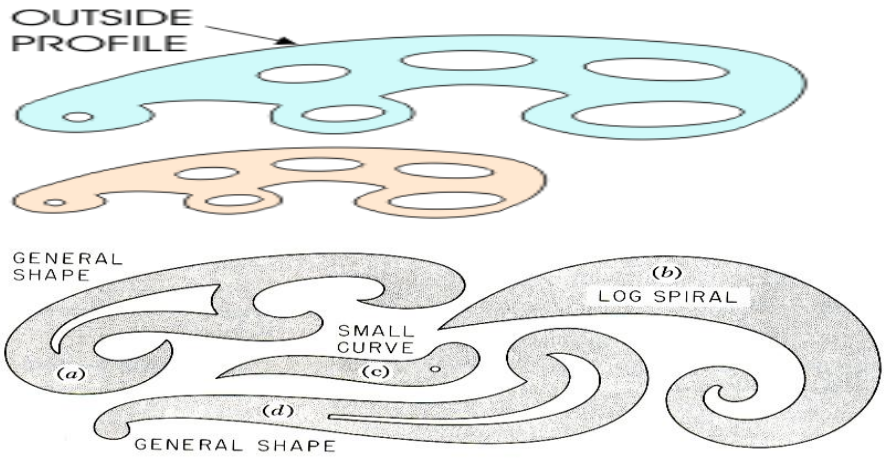


Fig 3.7 French curve

Drawing Pencils are a basic requirement of any graphics course. Ranging from 2B to 2H. This refers to the hardness of the pencil lead & sharp edge for longer and produces very fine lines.

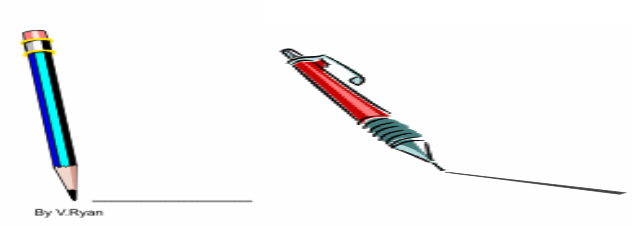


Fig 3.8 pencil

Pencil sharpeners:-are essential for sharpening pencils.



Fig 3.9 pencil sharper

A ruler should only to use to measure distances with lines being drawn with T-Squares and Set Squares.

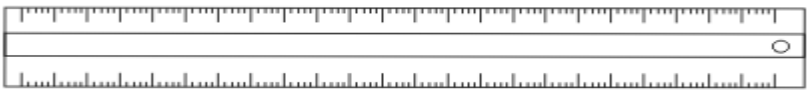


Fig 3.10 ruler

Erasers remove surface dirt.

Circle templates they are plastic with a number of accurate circles cut out.

Ellipse templates are similar to circle templates and these are useful for drawing ellipse / oval

Shapes accurately

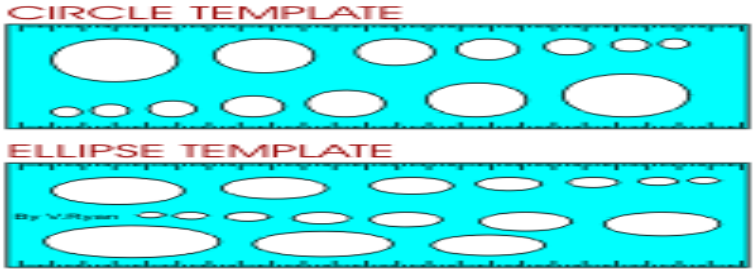


Fig 3.11 template

Papers: Each smaller size has an area half of the preceding size, and the length to width ratio remains constant. (A0, A1, A2, A3, A4).

Types of drawing papers: - There are two classes of papers.

A. **Detail paper**: It is primarily for pencil work that is not used in reproduction processes that require a degree of transparency of the paper.

B. **Translucent** paper also known as tracing paper: which is designed so that it can be used in common reproduction process.

It can be used for both pencil and ink work. Only limited erasing may be done on it before damage occurs to the paper's surface. Lead lines erase well, but inked lines do not.

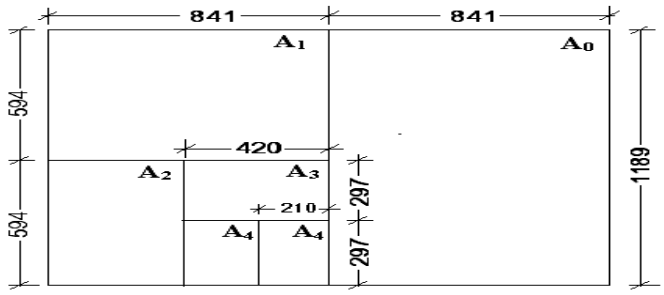


Table1.1.The most common A-series sheet sizes

A-Size	Dimensions in "mm"
A_0	841x1189
A_1	594x841
A_2	420x594
A_3	297x420
A_4	210x297

Setting up paper on a drawing board

Drawing paper must be set up on a drawing board using a T-square. Once in position, the paper is clipped to the board with board clips or masking tape.

1. The T-square must be placed up against the edge of the drawing board. There must be no gaps . Otherwise the paper will not be set up correctly and drawing accurate horizontal and vertical lines will be impossible.

2. The paper is then allowed to rest on the T-square. Check that the paper rests properly on the T-square and that there are no gaps between the T-square and the paper or the T-square and the

side of the drawing board. The clips can then be positioned holding the paper securely to the board.

3. A 2H pencil can then be used to draw faint horizontal lines across the page. Try to keep the lines to the same size by measuring them with a ruler.
Each time you draw a line check that the T-square is pressed completely against the edge of the board. There should be no gaps.

4. To draw vertical lines a T-square and set -square are used together. Be careful to check that there no gaps between the T-square and the board and the set- square and the T-square.

Drawing a border and title block A border is a line drawn around the inside edge of the paper. Usually this is 10mm (20mm) from the edge of the paper (left side of the paper) and (from bottom, top and right side of the paper) 5mm. It is basically a rectangle drawn precisely and inside this rectangle is the design area.

A title block is normally drawn at the bottom of the paper. Inside the title block is printed important information such as Name, Title and Date. The measurements for the title block can be seen below (these can vary depending on the type of title block being used). All the lines are dark with the exception of the guidelines between which the printing is positioned.

The border line and title block ensures that the design sheet looks more professional and includes vital information such as the designers name, the title of the sheet and the date.

Laying drawing paper (sheet).

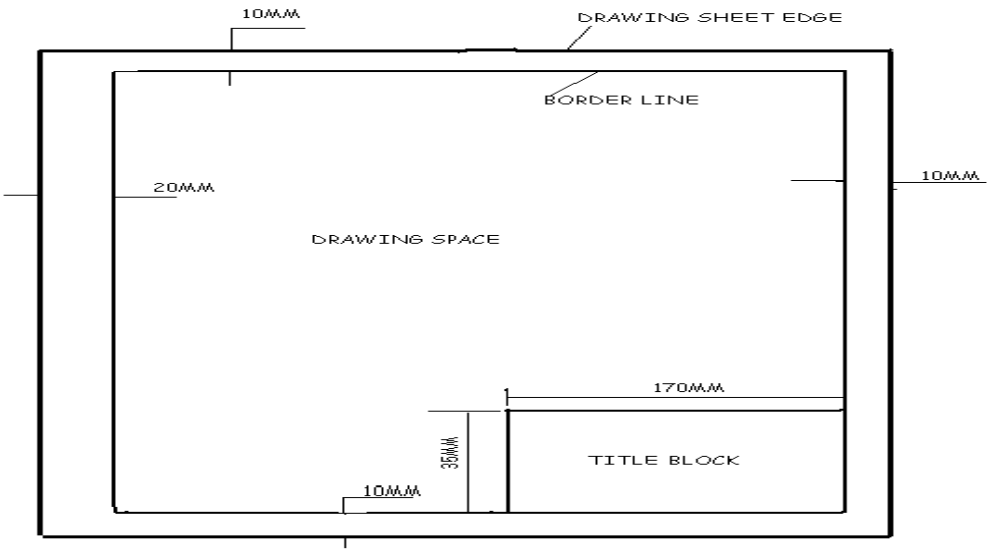


Fig1.3.14 drawing paper

1.3.2 Basic Drawing Equipment



Drafting Table



Drawing Board



Parallel Bar Drafting Machine



Elbow Drafting Machine

T-Square

Fig 3.13 drawing tool

1.4. Types of technical drawing

Definition of technical drawing

Technical drawing can be defined as the graphic representation of an object, concept or idea using a universal language that consists of graphic symbols produced with the aid of drawing equipment/tools that can be used to measure straight and curved lines according to specified dimensions ,scales, and codes of practice.

Technical drawing is used in many professions to draw (draft) ideas and different views of physical objects like drainages, culverts, septic tanks, incinerators, houses, etc. Drawing—either artistic or technical—is one of the oldest forms of communication, and is believed to be older than verbal communication.

1.4.1. Types of technical drawing

A. Artistic drawing

- Artistic drawing is the type of drawing that is abstract because its meaning is unique to the person/artist who creates it .In order to understand the meaning of an artistic drawing, one has to understand the artist's point of view or motivation for producing as pacific artistic drawing.
- It is mainly concerned with the expression of real or imagined ideas of cultural nature. Anyone can appreciate artistic drawing (even if each viewer has his own unique appreciation),

B. Technical drawing

- Abstract because it doesn't require an understanding of what its creator has in mind; conventions applicable technical drawing rather, it requires an In addition to the previously stated definition on
- Produced in graphic form by the use of universally accepted codes of practice ,tools, dimensions ,notes, symbols ,and specifications.

- It is concerned with the expression of technical ideas of practical nature & is the method used in all branches of technical industries & construction works of all nature. Engineering drawing requires some training to understand (like any language);

1.4.2 Working drawings for buildings

Orthographic building/construction drawings are a two dimensional representation of a structure. They are drawn in various scales depending on the detail and content required and offer the following advantages compared with other systems:

a. It's usually the simplest and quickest method of giving an accurate representation of an object.

b. Only those views that are essential need to be drawn.

c. Dimensioning is relatively easy.

d. Sectional and part views are easier to construct.

The only disadvantage of this method is that some training is necessary before you can draw or read a drawing. Sometimes it's easier to draw the object in perspective view (pictorial view), especially for clients who have difficulties interpreting orthographic drawings.

Building construction drawings usually show the following views:

- Plan view (Floor-plan)
- Elevations (faces of the building)
- Cross-Sections
- Details

For a building application to council the following plans are required

1. Site plan,
2. Floor plan(s),
3. Elevations,
4. Sectio

1.5. Key feature of technical drawing

1.5.1 Key features of drawings

Drawing sheets and layout features are standardized. It is essential that certain basic information be shown on every drawing. While some features may vary slightly, most drawings should have the following:-

FLOOR PLAN: -The most important step in the building is the floor plan.It contains more information than all the other working drawings. Essentially the floor plan of a buildings a horizontal section through the window, openings& door ways of the building taken a bout 150cm above the field line. In most building drawing each floor has its own plan& these are designated as ground floor plan, first floor plan, second floor plan……..etc.

Elevation drawing: - Elevation drawing shows the width, the height, of structural the exterior material found on the structural & the exterior design elements. Front& side views are drawn to give frontal & side look of the structural the of windows, doors, verandah, openings, parapets etc. Normally four view as show Front, Rear, Right Side, Left Side,

Section drawing;-Section of the building obtained with the aid of vertical cutting planes, serve to show the construction of certain elements of the building. Section is the orthographic projection that has been cut a part to show interior features.

Purpose of section: -Describe the construction material of the structure.

Site plan: - Site plan is the top view of building which shows the location of the house on the site together with information on terraces, walks, driveways, contours, elevations& utilities.

1.5.2 Shapes of site

Shapes are drawing elements, such as rectangles, circles, polygons, and lines. To create a drawing, get a shape by its service name at the Service Factory of a drawing document and add it to the appropriate Drawplate.

Drawing sizes vary, usually ranging from A0 to A4. The size of drawing sheets should be consistent within a single set of project drawings. Sometimes drawings or diagrams of

components and construction details are provided in A4 and bound in with specification data (for example, a specific engineering construction detail)

1.5.3 Dimensioning

❖ Is the process of specifying parts information by using of figures, symbols and notes?

This information is such as:

a. Sizes and locations of features
b. Material's type
c. Number required
d. Kind of surface finish
e. Manufacturing process
f. Size and geometric tolerances

❖ The basic concept

Dimensioning is accomplished by adding size and location information necessary to manufacture the object. This information has to be: -

- Clear ,
- Complete
- Facilitate the manufacturing method Measurement met

Example Designed Part

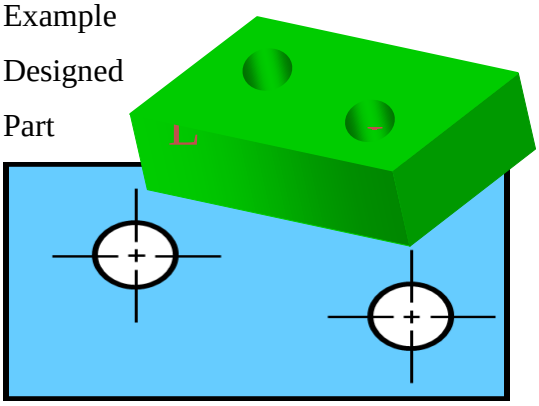
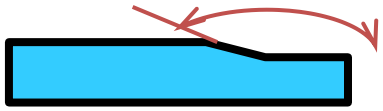


Figure1.2 5.1 Designed

To manufacture this part we need to know…Width, depth and Thickness of the part

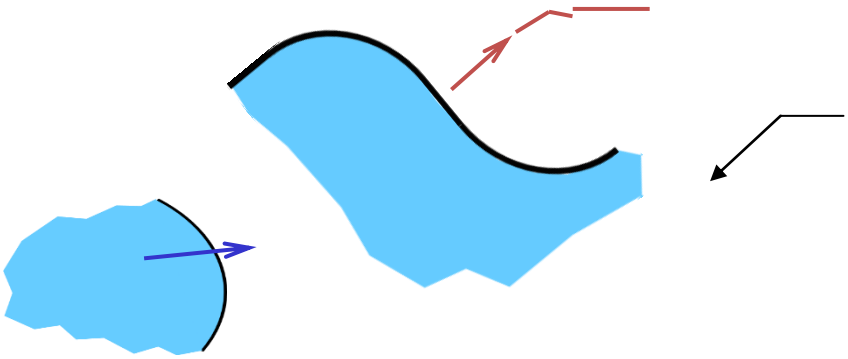
Diameter anddepth of the hole, Location of the holes.

- Angle To dimension an angle use circular dimension line having the center at the vertex of the angle



- Arcs are dimensioned by giving the radius, in the views in which their true shapes appear

The letter “R” is always lettered before the figures to emphasize that this dimension is radius of an arc. The dimension figure and the arrowhead should be inside the arc, where there is sufficient space



1.5.4 Building Orientation

1.5.4.1 What is Building Orientation

Building orientation refers to the way a building is situated on a site and the positioning of windows, rooflines, and other features. A building oriented for solar design takes advantage of passive and active solar strategies. Passive solar strategies use energy from the sun to heat and illuminate buildings. Building orientation and building materials also facilitate temperature moderation and natural day lighting. Active solar systems use solar collectors and additional electricity to power pumps or fans to distribute the sun's energy. Heat is absorbed and transferred

to another location for immediate heating or for storage for use later. Water, antifreeze or sometimes air circulates to transfer heat.

1.5.4.2 How to Optimize Building Orientation

It is best to incorporate passive solar systems into a building during the initial design. Passive solar systems utilize basic concepts incorporated into the architectural design of the building. They usually consist of: o Rectangular floor plans elongated on an east-west axis o Glazed south-facing wall of Thermal storage medium exposed to the solar radiation o Light shelves/overhangs or other shading devices which sufficiently shade the south-facing elevation from the summer sun; south elevation overhangs should be horizontal while east and west elevations usually require both horizontal and vertical overhangs5 o Windows on the east and west walls, and preferably none on the north walls In addition to passive solar and energy-conserving strategies, active solar systems can be integrated into a building's design and systems. Buildings designed to serve as active solar collectors should not be shaded by nearby trees or buildings and should have solar arrays or roof area facing south. Both passive and active solar collectors should be oriented at the angle of your location's latitude (in New Jersey, this is approximately 40°N)

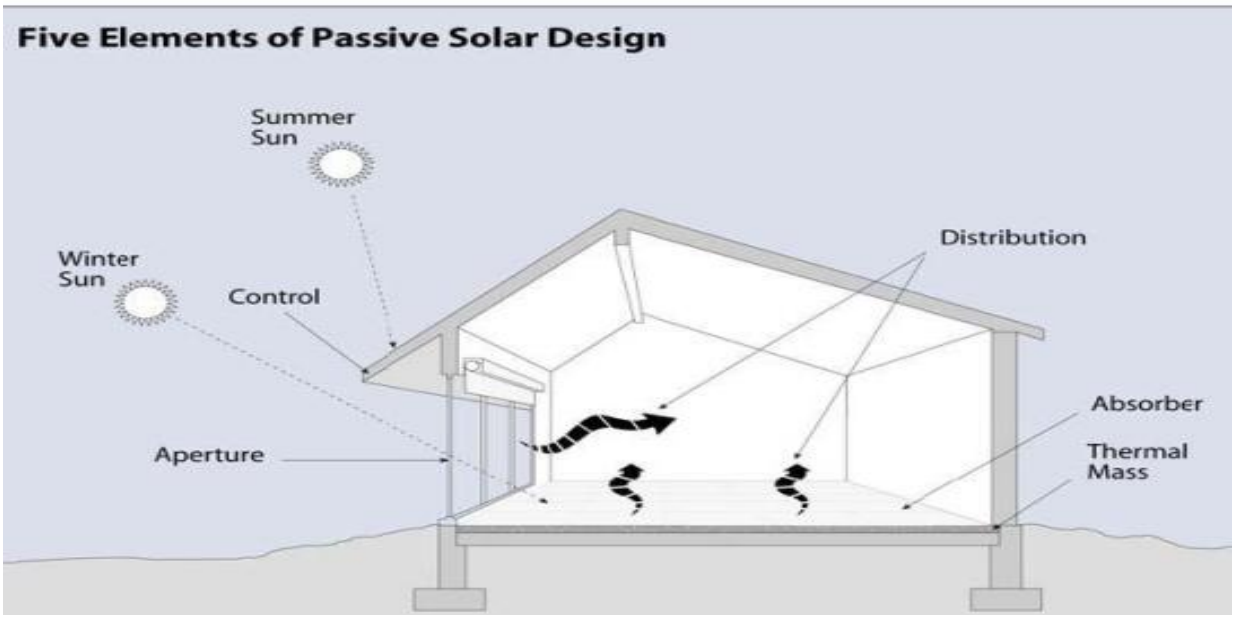


fig 5.2 elements of passive solar design

Self check-1

Directions: Answer all the questions listed below.

1. What are the key features of technical drawing?(3 points)
2. What is building orientation?
3. Write and explain the types of technical drawing?.
4. What are the advantages of working drawing for building construction?.
5. Explain the uses of the following technical drawing tools.
    A. Protractor Circular
    B. Template
    C. Drawing pencils
    D. T-Square
    E. French curve
6. Write at least 5 technical drawing equipments.
7. List out elements of natural environment?
8. List out elements of internal built environment?

Note: **Satisfactory rating –20 and 10 points Unsatisfactory - below 10**

You can ask you teacher for the copy of the correct answers.

Lap Test-1 practical demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 4hours.

Task 1: Place the drawing media on the drafting surface.

Task 2: Set the drafting machine at the "0" mark with parallel scale approximately Horizontal to the drawing surface.

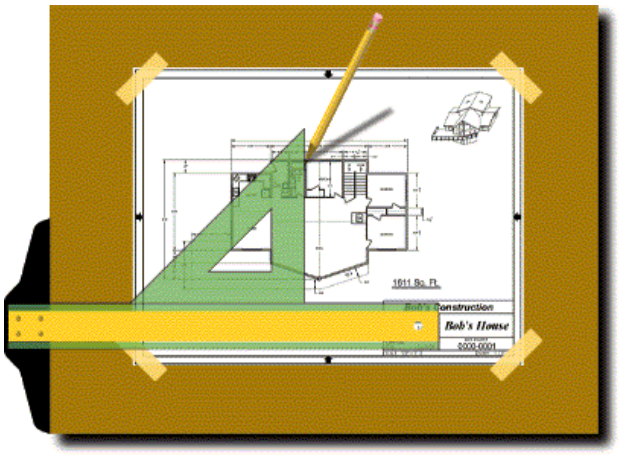
Task 3: Align the bottom edge of the drawing media with the parallel scale.

Task 4: Tape the drawing in place.

Task 5: Draw horizontal lines using the parallel scale as a guide

Task 6: Draw vertical lines by placing a triangle against the parallel scale and

Using the vertical 90° angle side of the triangle to trace along.



Unit Two: create simple sketches, orthographic drawing and sectional views

This unit to provide you the necessary information regarding the following content coverage and topics:

- Drawing medium selection
- Sketching drawing
- Three dimensional drawings and sketches.
- Simple building elevations and Sectional details
- Common symbols and abbreviations for technical drawing.
- Technical drawing title plan.

This guide will also assist you to attain the learning outcomes stated in the unit. Specifically, upon completion of this learning guide, you will be able to:

- Select Drawing medium is to suit job requirements.
- Prepare Simple two dimensional drawings and sketches are using standard drawing conventions.
- Prepare Simple three dimensional drawings and sketches are using standard drawing conventions.
- Prepare Sectional details of simple building elements and elevations are using standard drawing conventions.
- Use correct format, conventions , symbols and abbreviations.
- Preparing Title panels for technical drawing.

2.1. Standard drawing convention

2.1.1. Applying commonly used symbols and abbreviations

Symbols: the representation of actual object by some notation which convey the necessary information.

Architectural symbol &Abbreviations

- HCB – Hollow concrete block
- GIS – Galvanized iron sheet
- T—Double shutter
- S—Single shutter
- W—Window
- D—Door
- CB—Concert Block
- FF—Floor Finishing
- CIS-- Corrugated iron sheet
- Ar=architectural

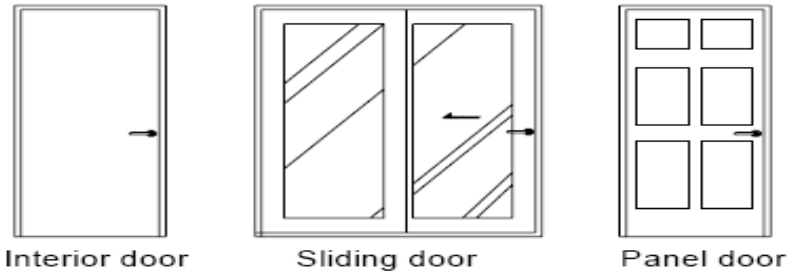


Figure 9. Examples of door symbols in plan view

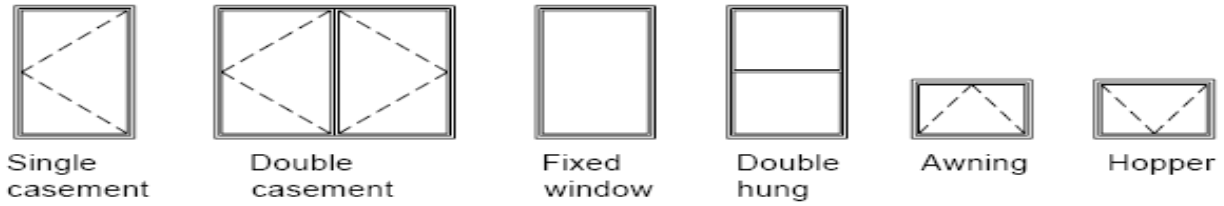
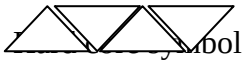


Figure 10. Examples of window symbols in elevation view

Structural symbol & abbreviation

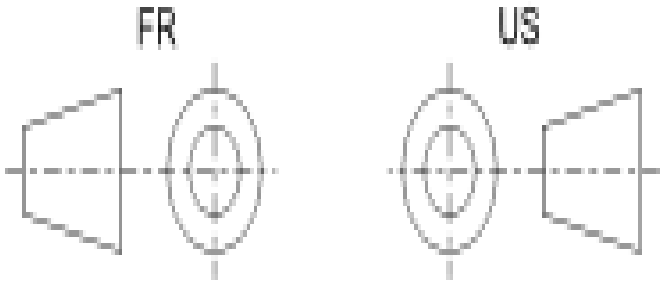
Table 2.1 Sanitary symbol &abbreviations

# = no of bar, Ø = diameter,  Column, beam & lintel ———— Bottom bar  Symbol	F=footing C=column IB= intermediate beam GB= grade beam TTB= top tie beam MH- Man Hole RCC-—reinforcement cemented concert	FC= footing column S=slab C/C= center to center J= joists L=lintel
WC- Water Close BD- Bidet S- Sink RCP- Reinforced Concert Pipe HWB- Hand Wash Basin	BT - Bath Tub AV- Air Vent KS- Kitchen Sink FD- Floor Drain CW- Cold Water	SH- Shower HW- Hot Water ST - Septic Tank WH- Water Heater W – Wash

Material symbols they are represent the construction material cut in section below is a section of material and thir symbols used on architectural drawing



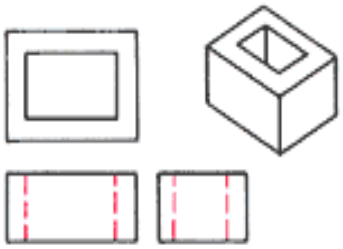
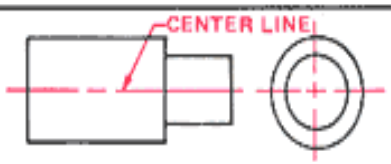
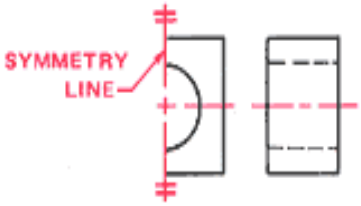
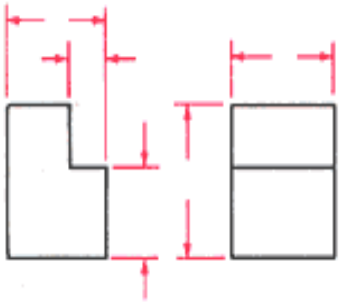
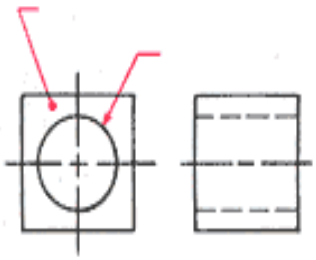
Projections Symbols

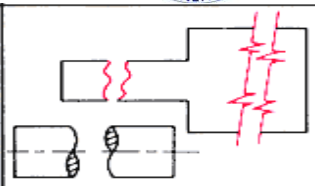
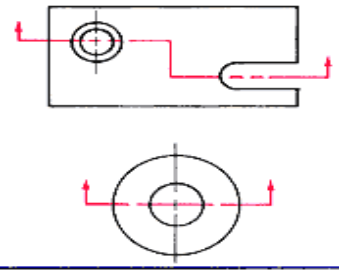
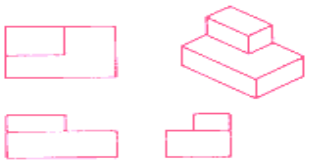
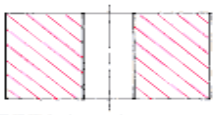
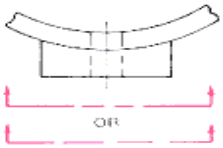
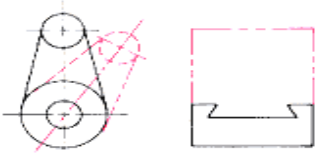


Symbols used to define whether a projection is either Third Angle (right) or First Angle (left).

Line symbol; To ensure correct communication between people of drawings, standards must be established. Standards include projection methods, terminology, dimensioning and symbols. Line has a definite meaning and sense to convey.

Table .2. types of line

TYPE OF LINE	APPLICATION	DESCRIPTION
HIDDEN LINE THIN		THE HIDDEN OBJECT LINE IS USED TO SHOW SURFACES, EDGES, OR CORNERS OF AN OBJECT THAT ARE HIDDEN FROM VIEW.
CENTER LINE THIN ALTERNATE LINE AND SHORT DASHES		CENTER LINES ARE USED TO SHOW THE CENTER OF HOLES AND SYMMETRICAL FEATURES.
SYMMETRY LINE CENTER LINE THICK SHORT LINES		SYMMETRY LINES ARE USED WHEN PARTIAL VIEWS OF SYMMETRICAL PARTS ARE DRAWN. IT IS A CENTER LINE WITH TWO THICK SHORT PARALLEL LINES DRAWN AT RIGHT ANGLES TO IT AT BOTH ENDS.
EXTENSION AND DIMENSION LINES THIN DIMENSION LINE EXTENSION LINE		EXTENSION AND DIMENSION LINES ARE USED WHEN DIMENSIONING AN OBJECT.
LEADERS ARROW DOT THIN		LEADERS ARE USED TO INDICATE THE PART OF THE DRAWING TO WHICH A NOTE REFERS. ARROWHEADS TOUCH THE OBJECT LINES WHILE THE DOT RESTS ON A SURFACE.

BREAK LINES THIN LONG BREAK THICK SHORT BREAK		BREAK LINES ARE USED WHEN IT IS DESIRABLE TO SHORTEN THE VIEW OF A LONG PART.
CUTTING-PLANE LINE THICK OR		THE CUTTING-PLANE LINE IS USED TO DESIGNATE WHERE AN IMAGINARY CUTTING TOOK PLACE.
VISIBLE LINE THICK		THE VISIBLE LINE IS USED TO INDICATE ALL VISIBLE EDGES OF AN OBJECT. THEY SHOULD STAND OUT CLEARLY IN CONTRAST TO OTHER LINES SO THAT THE SHAPE OF AN OBJECT IS APPARENT TO THE EYE.
SECTION LINES THIN LINES		SECTION LINING IS USED TO INDICATE THE SURFACE IN THE SECTION VIEW IMAGINED TO HAVE BEEN CUT ALONG THE CUTTING-PLANE LINE.
VIEWING-PLANE LINE THICK OR		THE VIEWING-PLANE LINE IS USED TO INDICATE DIRECTION OF SIGHT WHEN A PARTIAL VIEW IS USED.
PHANTOM LINE THIN		PHANTOM LINES ARE USED TO INDICATE ALTERNATE POSITION OF MOVING PARTS, ADJACENT POSITION OF MOVING PARTS, ADJACENT POSITION OF RELATED PARTS, AND REPETITIVE DETAIL.

2.2. Lettering for building line

2.2.1 Line

Pencil lines should be solid, uniform in width, and consistent in darkness throughout their length. If a line in a drawing needs to be changed, make sure to erase it clearly and recreate the line in appropriate line and quality. If only a part of the line needs to be modified, erase using the erasing shield and make sure the new segment and the existing segment match perfectly in width and darkness. Being consistent also applies to pen and ink drawings and CAD drawings. A pen and ink drawing is usually made first with a very light guidelines. When using ink technical or drafting pens, typically the light, medium, and dark weights are created in proportion to one another. For instance, if light is a width of 0.05, then medium is 0.10 and dark is 0.20. The actual width of each line type should also be related to the size and scale of the drawing. A drawing in ¼" scale, like floor plan, ma need smaller pen widths than a drawing in 1 – ½" scale, like a kitchen cabinet drawer detail. The best way to create consistent line weights and line quality is to keep your pencil or pen perpendicular to the drawing surface and drawing media. This keeps the width of the line consistent. Also, keep a constant pressure as you draw a line type from its start to finish. This takes a practice and can be mastered if you focus on creating the line constantly and do not try to rush a drafted document.

A proper choice of lead pencils for particular drafting purpose should be selected. The grade of pencil to be used for various purposes depends on type of the line desired, the kind of paper employed, and the humidity, which affects the surface of the paper. Standards for line quality will govern the selection for instance :

- 6H is used for light construction line
- 4H is used for re-penciling light finished lines (dimension lines, center lines, and visible lines)
- 2H is used for visible object lines
- F and H are used for all lettering and freehand work

✓ Guidelines or Construction lines (4H to 6H pencil lead in a 0.3mm mechanical pencil)

Construction lines are very light, gray lines used to lay out all work. They should be light enough on a drawing so they will not reproduce when making a print. The initial lines that you draw on your paper are guidelines or what some refer to as construction lines. These lines are temporary

and used to lay out the page, create the initial shapes, and provide a guide for lettering heights. The line weight for guidelines is to be very light as they should be almost invisible on the finished drawing. They must be dark enough for you to see, light enough to erase lines easily, and barely visible when copies or other form of reproduction are made from the drawing. Using a harder 4H to 6H pencil lead in a 0.30mm mechanical pencil creates the best guidelines. You can also use a blue lead guidelines as it will not photocopy.

- ✓ Bold Lines (soft B to 2B pencil lead in a 0.50mm or 0.7mm mechanical pencil)

The primary objects in a drawing should be created using a bold line. Bold lines are very dark and have a thick width. These are created with a 0.50mm or 0.70mm mechanical pencil and a soft B to 2B pencil lead. Walls in plan view and the outline around the perimeter of an elevation or three-dimensional object are examples where bold lines should be used.

- ✓ Medium Lines (HB pencil lead in a 0.50mm mechanical pencil)

Secondary objects such as doors, furnishings, counters, and cabinets should be in a medium line weight. In elevation and 3D views, the perimeter of an object may be drawn in a bold line weight, however the information inside the object should be drawn in a medium weight. Medium line weights are best are best created using a 0.50mm width pencil with HB pencil lead.

- ✓ Light Lines (H to 2H pencil lead in a 0.30mm or 0.50mm)

Action lines, information lines, and fill patterns should be drawn with light lines. Action lines show potential movement of an object include door swings in plan view and hinge direction in elevation view. Information lines convey information about a drawing and include dimension lines, center lines, leader lines, section lines and so on. Fill patterns are specific symbols used to indicate a type of material being used. The light lines can be created with a 0.50mm pencil or with a 0.30mm pencil and H to 2H pencil leads. It is very important that all of these lines are visible, so do not confuse the term “light” with “hard to see”.

- ✓ Border Lines(2B to 4B pencil lead in 0.7mm or 0.9mm pencil with a 2B to 4B lead works well for creating borderlines. These lines are the heaviest of all the lines in the drawing

Dimensions

A drawing without dimensions is meaningless. Dimensions are necessary to show the exact size of an object. Dimensioning refers to the act of giving dimensions, i.e., length, width, height, diameter, etc., of the object. This information is provided by giving numeric values to various features of the object on the drawing. A feature is an individual characteristic such as a flat or cylindrical surface, a slot or a groove, a taper, a shoulder, a screw thread, etc.

Dimension is a numerical value expressed in appropriate units of measurement and indicated graphically on technical drawings with lines, symbols and notes. The important aspects of **dimensioning are as follows:**

- ✓ Units of Measurement: On technical drawing we need to show lengths and angles. The most convenient unit for length is millimeter. In civil engineering and architectural drawing, inch or foot is often used as a unit of length. Angles are shown in degrees.
- ✓ Symbols: Are incorporated to indicate specific geometry whenever necessary.
- ✓ Notes: Are provided to give specification of a particular feature or to give specific information necessary during the manufacturing of the object.

Elements of dimensioning

A line on the drawing whose length is to be shown is called and object line. The object line is essentially an outline representing the feature(s) of the object. While showing an angle, the two lines forming the angle will be the object lines.

Dimensioning is often done by a set of elements, which includes extension lines, dimension lines, leader lines, arrowheads and dimensions.

- ✓ Extension line – is a short line drawn perpendicular to an object line. These line start immediately or a few millimeters from the ends of object lines and extend a few millimeters beyond a dimension line. Extension lines may be used to show an angle due to space constraint. In such case, extension lines are drawn parallel to and at the ends of object lines.
- ✓ Dimension line – is drawn between two extension lines parallel to the object line. As a rule, there must be one and only one dimension line between any two extension lines. One dimension line represents one dimension. While dimensioning an angle, a curved dimension line is drawn by drawing a suitable are having its center at the vertex of the angle.
- ✓ Leader line – is a line which connects a note or a dimension with the feature to which it applies. Leaders are drawn at suitable angles, preferably 30º, 45º or 60º, and are never drawn horizontal or vertical. One end of the leader carries an arrowhead which connects it to the outline of the object. A dot is used instead of an arrowhead, if the leader ends inside the object, figure 3.2(b). The other end of the leader is made horizontal. A note or

dimension is placed above the horizontal portion of the leader. Leaders are frequently used to indicate the diameter or radius of a circular feature.

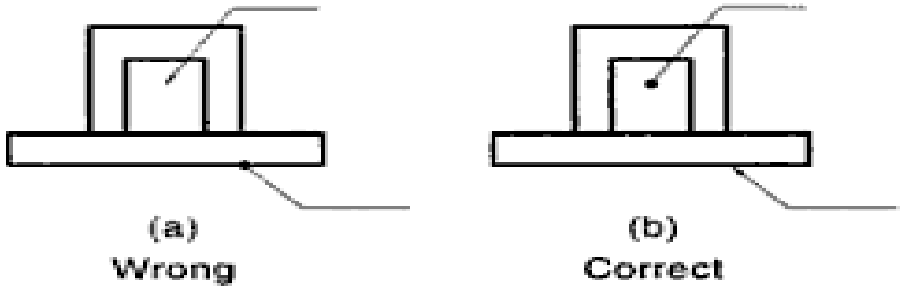
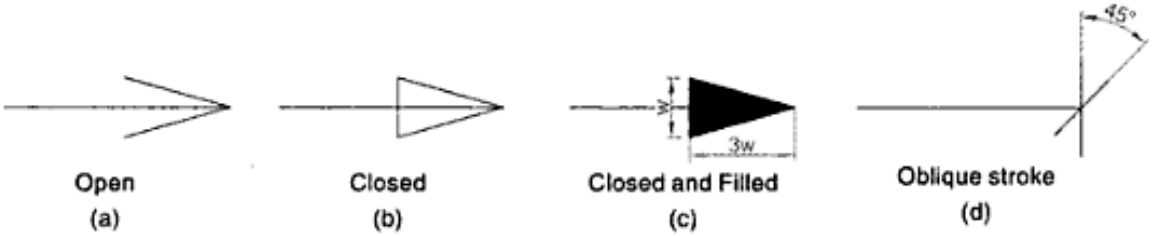


Fig. 3.2

- ✓ Arrowheads – an arrowhead is drawn at each end of a dimension line. The tip of an arrowhead touches the extension line. An arrowhead is also drawn at the end of a leader, which points out the feature of an object. The various styles of drawing an arrowhead are shown in the figure below. The arrowheads may be open, closed, or closed and filled. The angle formed the barbs of the arrowhead usually varies from 15º to 90º. Sometimes, an oblique stroke drawn at 45º to the extension line is used instead of an arrowhead



2.3. Sketching drawing

2.3.1 basic free hand sketching

Sketching is the creation of graphic images that are approximate graphic representations models. Freehand sketching is manual sketching with the minimum of tools such as paper and pencil. Technical sketching is the art of creating technical drawing using freehand without special instruments. Technical sketching requires correct shape or form and more so correct size indication.

Generally, drawing tools refer to the materials used as aids when creating drawings and they vary from simple to complex instruments and equipment. However, the drawing needs of today have changed dramatically due to the availability of computers. Traditional design and drafting has largely given way to computer design drafting but design sketches will always be needed. Rough Sketching Tools

Rough or freehand sketching tools are quite few and require minimum investment. They are pencil, paper, eraser, and pencil sharpener. Fig. 1 shows sketches of pencil, eraser and pencil sharpener. A) Wooden pencils b) Eraser c) Pencil sharpener

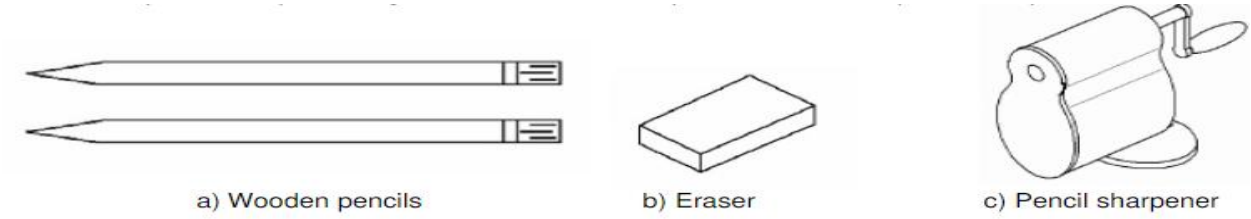


Fig. 2.1 shows sketching instrument

Freehand sketching is one of the effective methods to communicate ideas irrespective of the branch of study. The basic principles of drawing used in freehand sketching are similar to those used in drawings made with instruments.

- **Rules in Sketching**
  - A scale is not required.
  - Sketches are drawn in proportion. (NOTE: Gridded paper can be helpful to keep objects proportional.)
  - Small objects are sketched larger than their normal size.
  - Freehand lines are rough, not rigid.

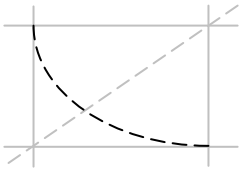
- Line contrast should be used.
- A soft pencil should be used.
- Finished line work should be dark and conform to line alphabet standard.
- Sketches are dimensioned the same as machine drawings.

➢ **Steps in completing a drawing**

- Select necessary views.
- Block in lightly the shape of the object.
- Block in details in each view.
- Erase unwanted construction lines.
- Darken lines.

➢ **Methods for proportioning a sketch**

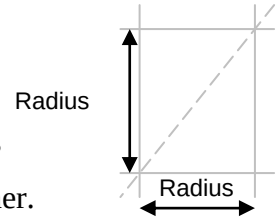
- Approximation by eye method
  - Object is studied for its various shapes.
  - Size of each shape is compared to each other.
  - Size of shape is compared with overall width, height, and depth of object. (NOTE: Use part of the object as reference point to compare against.)
- Pencil and eye method – The pencil is used as measuring stick to proportion height, width, depth and angels. (NOTE: This is commonly known as an artist technique.)
- Actual measurement methods:-
  - Scale
  - Proportional divider
  - Calipers

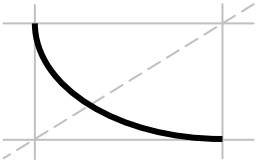


➢ **Types of grids available for freehand sketching**

- Graph paper- 4, 5, 8 or 10 squares per inch.
- Isometric grid – Graph paper with guide lines at 30 angels from the horizontal.
- Perspective grid- Graph paper that provides vanishing points and projection lines for one-two-point perspective.

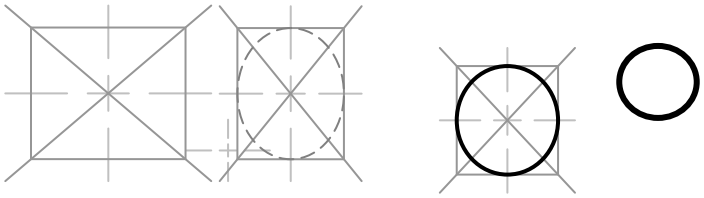
❖ **Sketch arcs**





- Guidelines for sketching arcs
  1. Sketch a box corner.
  2. Mark off radius distance from corner point.30598649

3. Swing a rough arc from center point.
4. Darken arc.



❖ **Sketch circles**

- Guidelines for sketching circles.
  1. Sketch in center lines.
  2. Box in circle at a diameter required.
  3. Put in diagonal lines and marks radius points from center.\
  4. Rotate wrist in a circular motion and connect arcs
  5. Erase construction lines and darken outline.

Sketch ~ this can be defined as a draft or rough outline of an idea, it can be a means of depicting a three-dimensional form in a two-dimensional guise. Sketches can be produced free-hand or using rules and set squares to give basic guide lines.

All sketches should be clear, show all the necessary detail and above all be in the correct proportions.

Sketches can be drawn by observing a solid object or they can be produced from conventional orthographic views but in all cases can usually be successfully drawn by starting with an outline `box' format giving length, width and height proportions and then building up the sketch within the outline box.

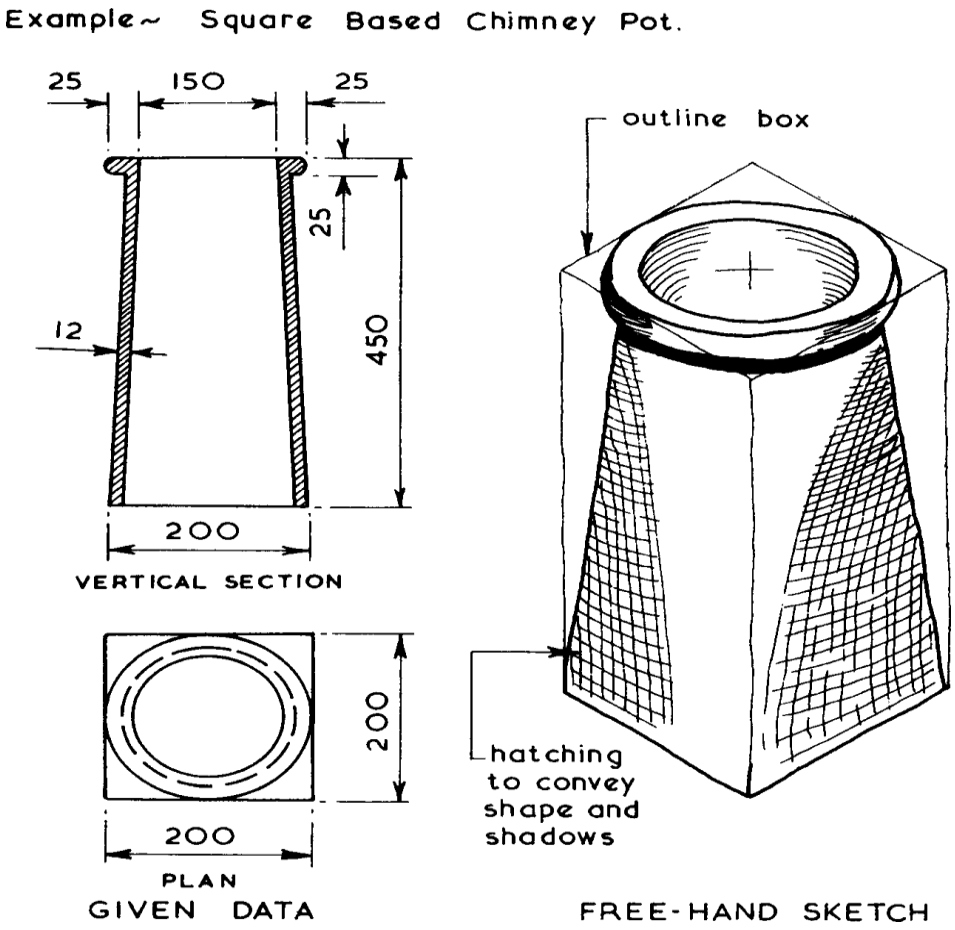


Fig2.3.1 free hand sketch

2.3.2 Two dimensional drawings

The objects around us come in various different shapes and sizes. We can see triangles, squares, and circles everywhere. Some of these shapes like the shape of a house have length, breadth, and height and are the 3D or the three-dimensional objects. Others like a sheet of paper can be imagined to have a length and a breadth only. Such objects are the two-dimensional objects and form the 2D shapes. Let's learn more about them

Everyone is familiar with the most common shapes: square, circle, rectangle, and triangle. Each of these shapes is created by combining specific amounts of lines and/or curves.

A square: for example, is a four sided figure created by connecting four line segments. All of the line segments are of the same length and they come together to form four right angles.

A circle: on the other hand, has no straight line. It is a combination of curves all connected. There are no angles to be found in a circle

A triangle: consists of three line segments connected. Unlike a square and a rectangle the angles in a triangle can be of various measurements and are not always right angles.

A polygon : is a shape that is closed and is made up of only lines (no curves). It can have no open parts

A parallelogram: is named because the opposite sides of the shape are parallel

2.3.3. 2D shapes

A shape or a figure that has a length and a breadth only is a 2D shape. The sides are made of straight or curved lines. They can have any number of sides. Plane figures made of lines are called polygons. Triangle and squares are the examples of polygons. We will classify figures we have seen in terms of what is known as the dimension. A plane object that has a length and a breadth only has 2 Dimensions. The following are examples of two-dimensional shapes you should be able to recognize

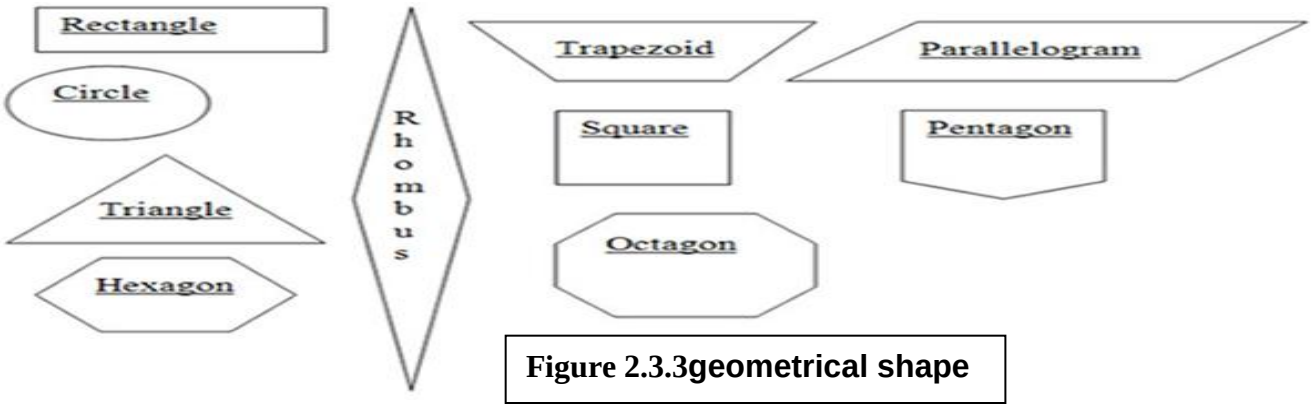


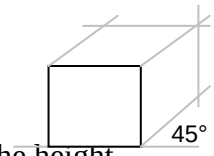
Figure 2.3.3geometrical shape

2.4. Three dimensional drawings sketches

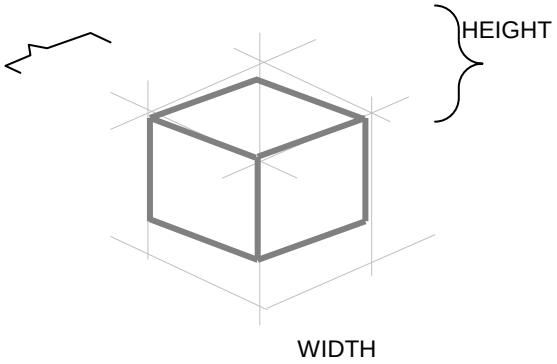
2.4.1. Sketch an isometric cube

Guidelines for sketching an isometric cube

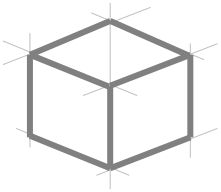
Lay out the isometric axes.



2 Sketch an isometric box so the height, width, and depth of the box, are the same as the object (cube).



3. Darken all final lines.



4. **Erase construction**

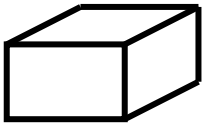


Fig 2.3.4 Sketching an oblique cube

Guidelines for sketching an oblique cube

1 Sketch the front view of the object (cube). The height

And width is the same as the object.

2 Sketch receding axis lines. (NOTE: 45◦ angle is a common angle to use.)

3 Estimate the depth. Then draw the back edges.

4 Sketch all details and darken final lines

5 Erase construction line

2.3.1 orthographic drawings

An orthographic drawing represents a three-dimensional object using several two-dimensional views of the object. It is also known as an orthographic projection. For example, you can see in this image the front, top and side views of a simple object.

The projection box is an imaginary box wherein the object shall be placed in to easily identify the three principal views needed the top, front and side views. (Shown in the figure /illustration below)

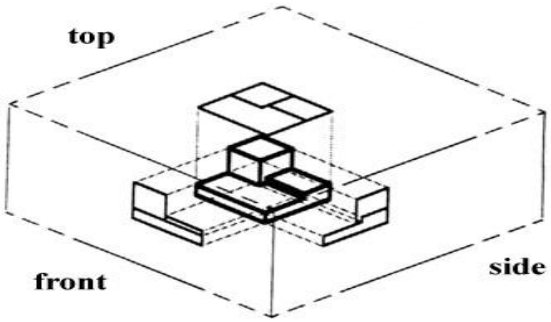


Figure 3.1 imaginary box

Assembling the drawing

Sometimes there are given parts of an object using the orthographic illustration, your concern will be identifying the perspective figure to complete a task. An example figure below is given to find the perspective

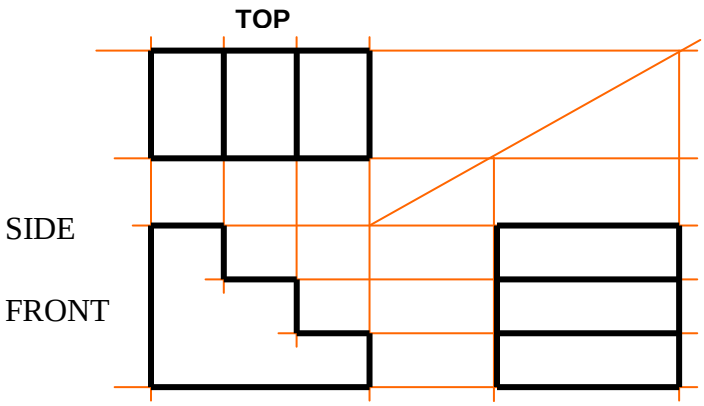
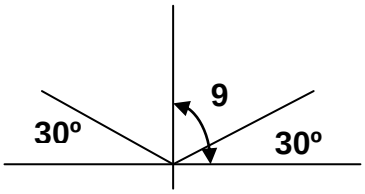


Figure 2.3.5 Assembling part

Steps in assembling the parts

Step 1: Follow the procedures of Isometric drawing. Create first the 30º angles

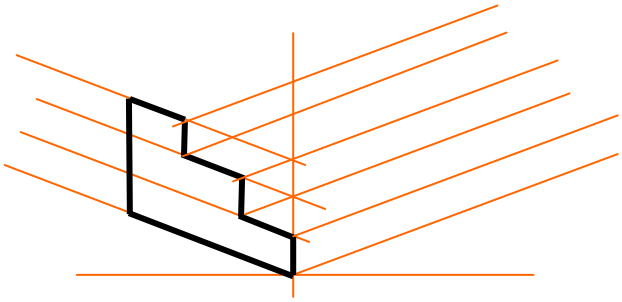
Used in creating Isometric figures.



Step 1

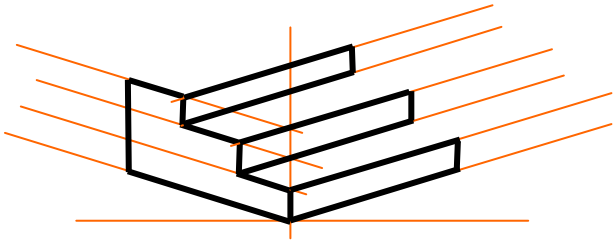
Step 2: draw the front view first, following the given measurements.

Project the side view after completing the front view.



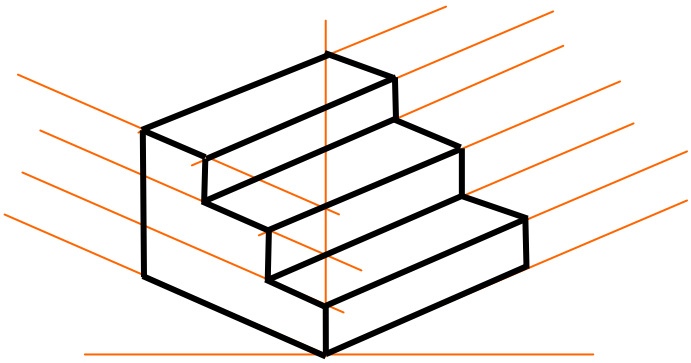
Step 2

Step 3: draw the side view according to the details or measurements given.



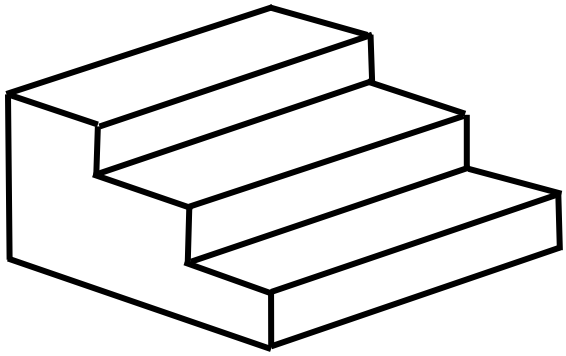
Step 3

Step 4: Project the remaining lines that will complete the top view. After completing the figure, erase all unnecessary lines or the projection lines.



Step 4

Step 5: erase construction lines



Step 5

3.3 Orthographic projections

This is a graphical method used in engineering drawings. The word orthographic is derived from the Greek words ortho-*straight, rectangular* and graphos-*written, drawn*. A drawing of a structure or part thereof can be drawn using the following projection methods:

There are two methods of drawing orthographic projections:

1) first angle projection and 2) third angle projection

1 First Angle Projection

when the object is situated in First Quadrant, that is, in front of V.P and above H.P, the projections obtained on these planes is called First angle projection.

2 Third Angle Projection

In this, the object is situated in Third Quadrant. The Planes of projection lie between the object and the observer. The front view comes below the xy line and the top view about it.

They are based on right angle planes with defined separate spaces, or quadrants. Each quadrant could Obtain an object to be presented. Example:-

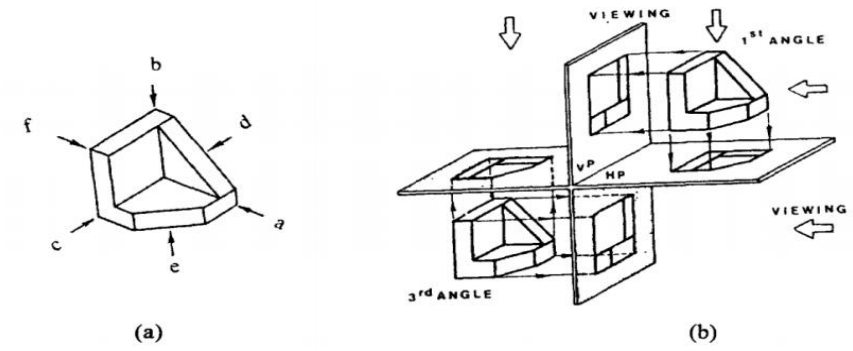


Figure3.3 (A) and (B) Principles of orthographic projection.

3.3.1 designation and relative position of view

An object in space may be imagined as surrounded by six mutually perpendicular planes. So, it is possible to obtain six different views by viewing the object along the six directions, normal to the six planes. Fig.(A) shows an object with the six possible directions to obtain the six different views which are designated as follows.

1. View in the direction a = front view
2. View in the direction b = top view
3. View in the direction c = left side view
4. View in the direction d = right side view
5. View in the direction e = bottom view
6. View in the direction f= rear view

Note: A study of the Figure (B) reveals that in both the methods of projection, the views are identical in shape and size but their location with respect to the front view only is different.

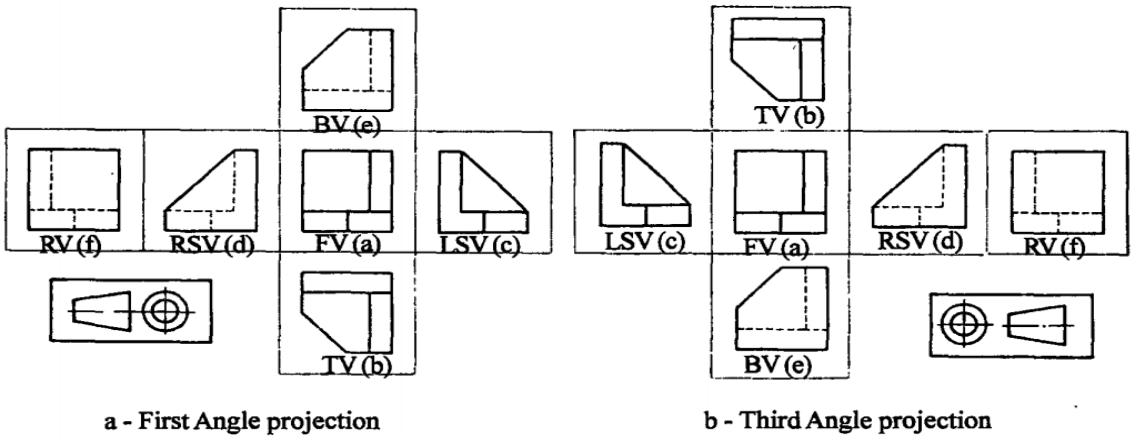


Figure3.4 (A) and (B) Relative Positions of Views

Both systems of projection are approved internationally and the system used is clearly indicated on all engineering drawings with the following illustrations:

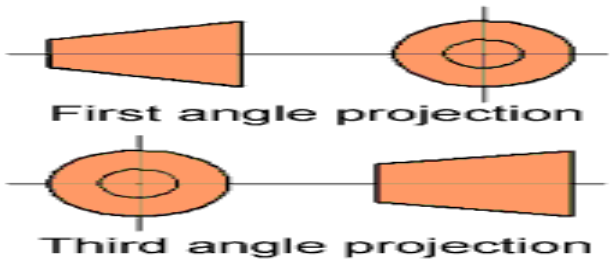


Figure 3.5 projection symbol

In which projection architectural and builders working drawings are represented is generally in significant. However, it is important that you understand the basic principles of orthographic projection and be able to construct orthographic views of objects.

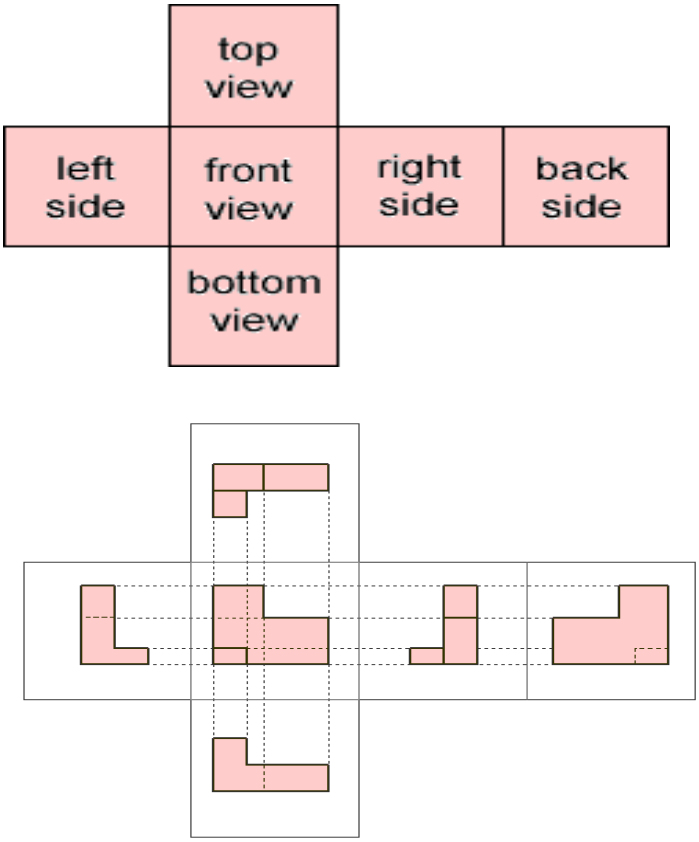


Figure 3.6 six side projection view

Typical orthographic projection for one class house

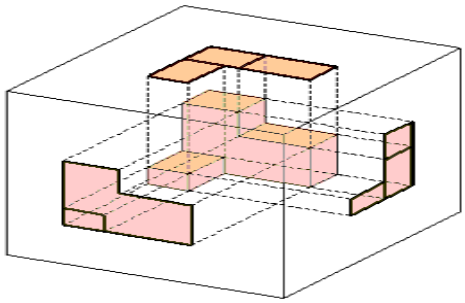
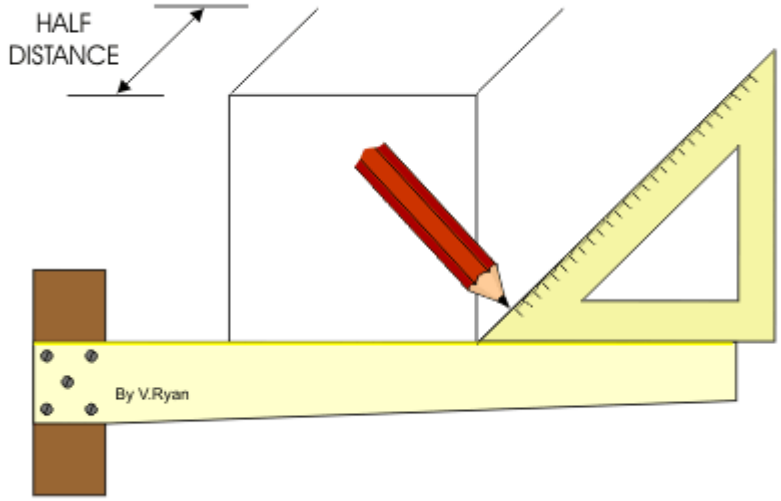


Fig 3.8

Isometric Projections ~ a pictorial projection of a solid object on a plane surface drawn so that all vertical lines remain vertical and of true scale length, all horizontal lines are drawn at an angle of



30 and are of true scale length therefore scale measurements can be taken on the vertical and 30 lines but cannot be taken on any other inclined line.

A similar drawing can be produced using an angle of 45 for all horizontal lines and is called an Axonometric Projection

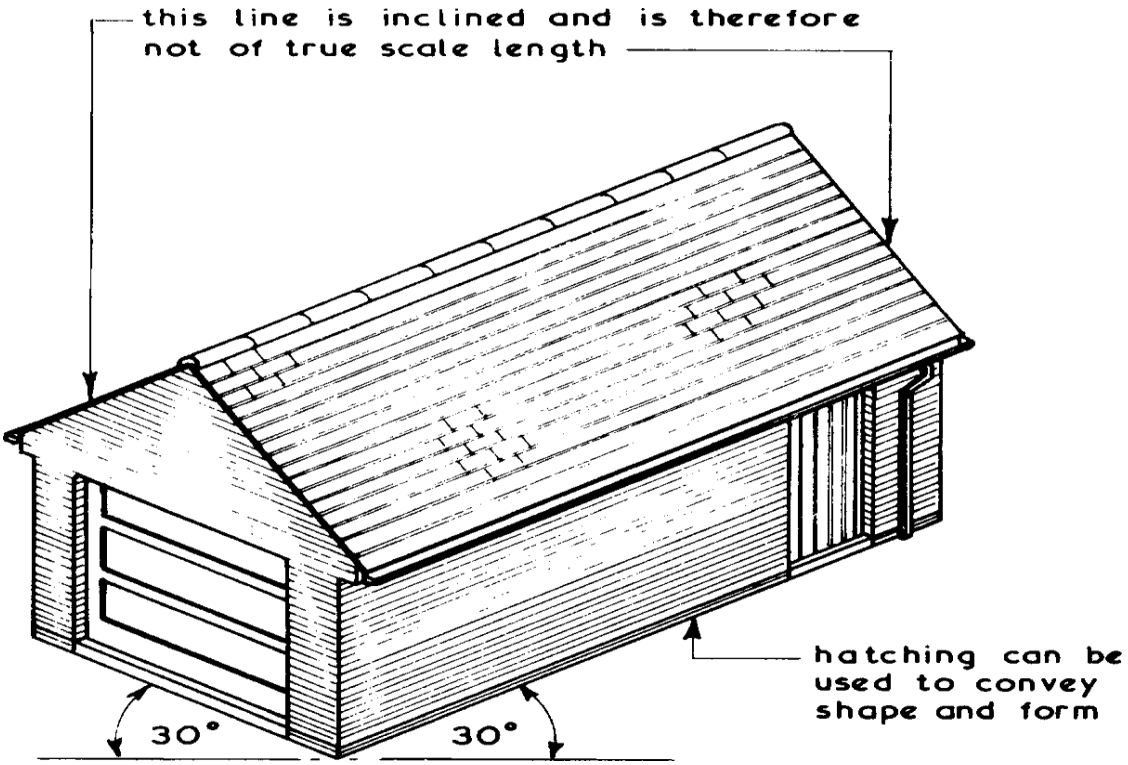


Fig 3.9 Axonometric Projection

ISOMETRIC PROJECTION SHOWING SOUTH AND WEST ELEVATIONS OF SMALL GARAGE AND WORKSHOP ILLUSTRATED ON NEXT PAGE.

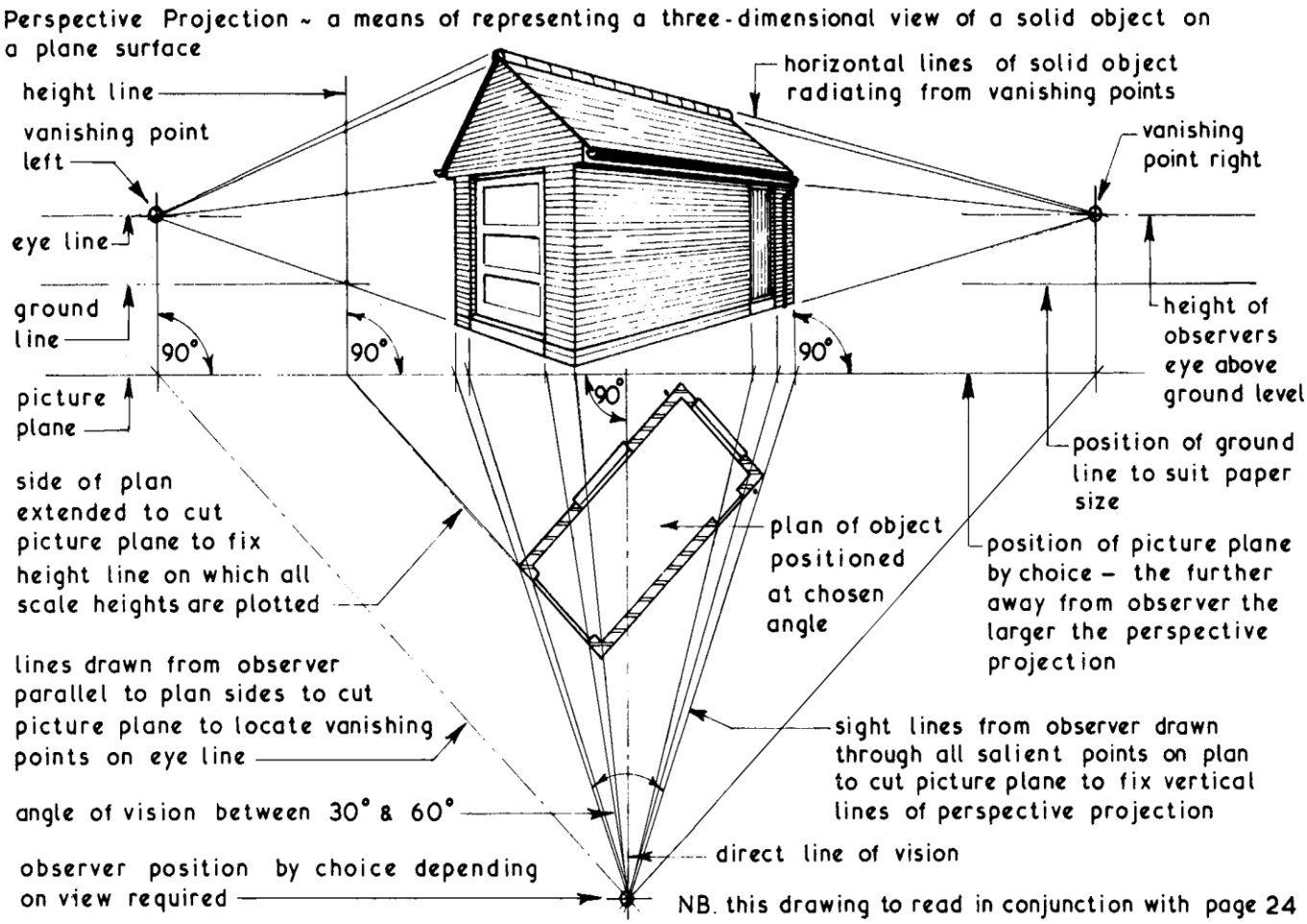
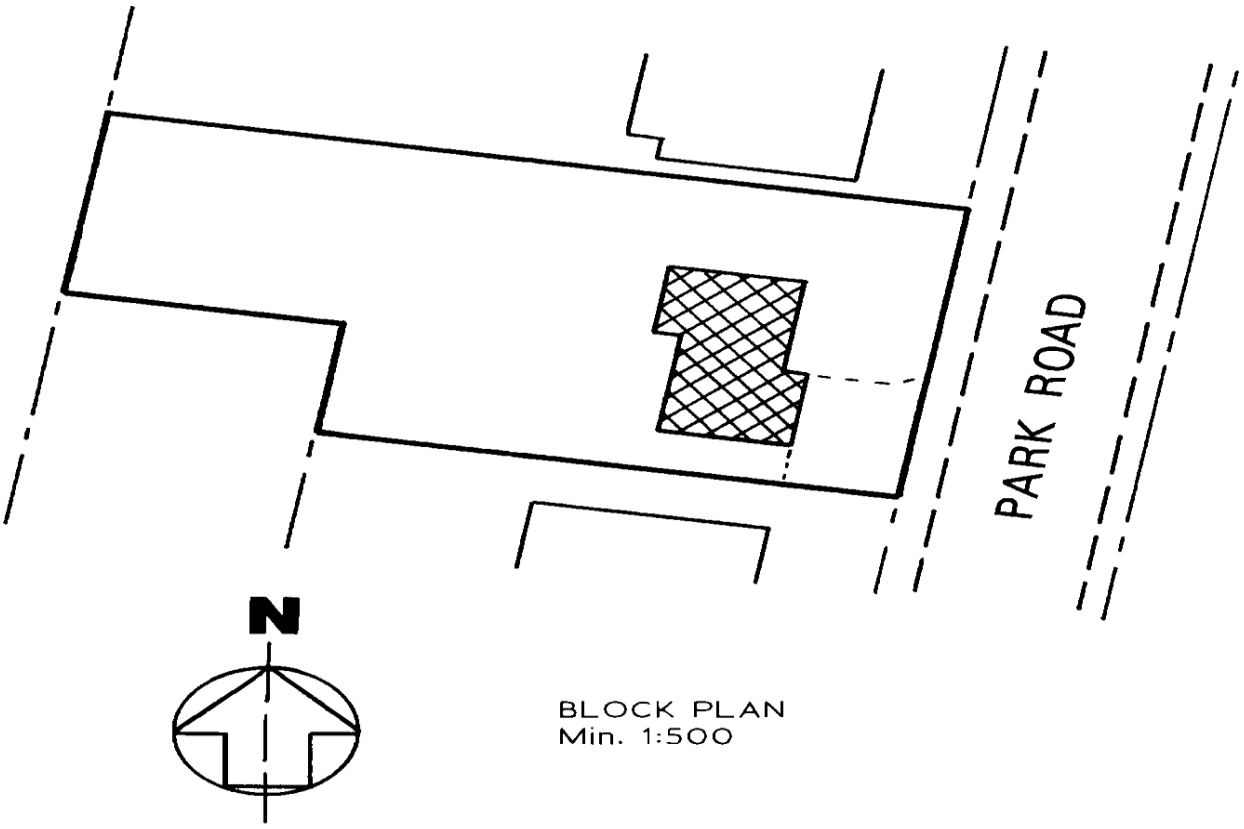
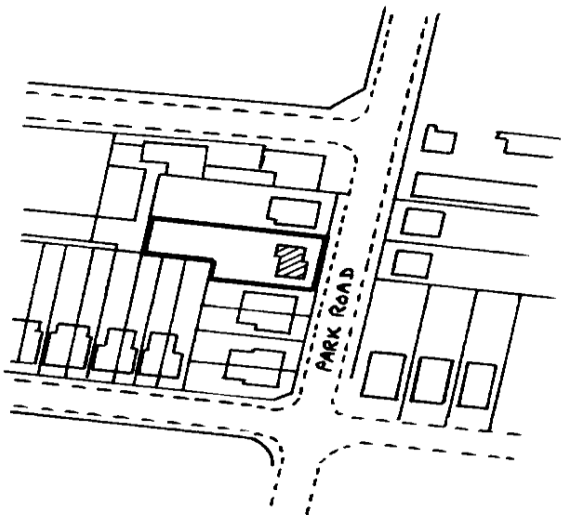


Fig 3.10 Axonometric Projection



BLOCK PLAN
Min. 1:500

SITE PLAN
Min. 1:2500



2.5. Simple building elevation and sectional detail

All buildings have the same components such as foundation, walls, floors, and roof. In addition, we have to decorate them with plaster, paint, etc., to make them aesthetically beautiful.

These items of building works are called civil works. Water and electricity have also to be supplied to the buildings to make them habitable. These items are called building services. In this article, we will briefly examine the various components of civil works and building services.

A building can be divided into substructure (foundation) and superstructure, the plinth level being the dividing line between them. In building construction, we study how the civil works are carried out in the field after they have been planned by an architect and structurally designed by an engineer.

We should be aware that many aspects are involved in the preliminary planning and design of buildings.

The following are some of the different types of foundation generally used:

Foundation. Foundation is a very important part of a building.

All the loads of superstructure are transmitted to the foundation.

A foundation engineer should know how to examine the soil profile and arrive at a suitable foundation.

The following are some of the different types of foundation generally used:

Strip foundation (shallow foundations)

Footing foundation (shallow foundations)

Raft foundation (shallow foundations)

Pile foundation (deep foundations)

Pier foundation (deep foundations).

In framed construction, we use footings as the foundation for the column and the brickwork for walls starts from grade beams connecting columns.

(Grade beams on under-reamed piles are also called capping beams).components-of-a-building

Read Also: Unit Weight of Building Materials [A Complete List].

Plinth The plinth is a dividing line between the substructure and superstructure.

Thus, the projecting part of the wall above the ground level to the floor level is the plinth.

The plinth is usually kept at least 45 cm (1.5 ft.) Above the general ground level of the building.

Plinth Beam. It is capped by a beam called plinth beam. The provision of a plinth beam and damp-proof course at plinth level are very important in building construction.

Damp Proof Course (D.P.C). The damp proof course is a layer provided in building to prevent the entering of dampness from the ground to the building components.

Walls and Columns. Walls are mostly made of masonry. Itmay be of brick, block-work, stonework, etc.

Buildings may also be constructed as a framed structure with columns and footings and

Then Walled. Most of the flats and high-rise buildings are built this way.

In many places in the masonry, we use arches and lintel

Floors. Floor is an important part of a building. It is the place where the inhabitants perform their most activities. It is constructed on the filling and laid over the plinth level. Floors are usually made from different types of materials, such as, timber, brick, R.C.C. Top floors are nowadays usually made of reinforced concrete. Read Also: Fineness Test of Cement; Its Apparatus, Procedure.

Roof. A roof is an important part of all buildings. The most important item in housing is to have a "roof over one's head." A roof is a layer which covers the structure from the top. It also prevents the building and inhabitants from the ill effects of the environment. Depending on the finances available and also the climatic conditions, we can have different kinds of roofs. Roofs can be sloped or flat. Many types of roofs and roofing materials are available nowadays. Watch the video below for better understanding.

Fabrication of Doors and Windows. Openings are necessary in buildings for passages inside and outside the buildings. We also need windows for lighting and ventilation.

A detailed study of doors and windows is an important part of building construction as the expenditure on this item alone can go up to 15 to 20 percent of the total cost of civil works. Traditionally, doors and windows were made of wood and hence, this work is sometimes referred to as woodwork in buildings. Other woodworks like provision of cupboards are also important, but it comes under the subject of interior decoration.

Stairs and Lifts. Nowadays most buildings are made more than one story high. Which means there should be a way to go from one story of the building to another Knowledge of various elements of a staircase and the construction of a simple staircase is essential to all those involved in building construction. Study of the layout and design of ornamental staircases is a special subject.

Usually, vertical transportation devices like electric lifts are to be provided in buildings having more than four floors including the ground floor. We must also be familiar with these devices.

Building Finishes. The final appearance of a building depends very much on its finishing. We have to deal with the following:

Plastering and pointing

Painting of walls, woodwork, grillwork, etc.

It is essential that we have knowledge of the finishing to be used on the various materials of construction such as plaster, wood, metals, etc.

Building Services. Water supply, drainage, sanitation, electric supply lifts, external works, construction of cupboard, etc. Are considered as items outside of civil works and are called building services. Water supply, drainage, and sanitation (building service). These works are considered separate from civil works and are also estimated separately. Design and details of these will be studied in public health engineering under building services. However, an elementary treatment of the subject is always included in basic building construction.

Electrical works (building service). Lighting and supply of electricity for various pieces of equipment used in buildings also come under building services. The supply and distribution of electricity in a building is a specialized work to be carried out by an electrical engineer. However, the basics of these works are also usually dealt with in

What is Building Section or Section Drawing?It is possible to take a single plan and develop it for several completely different sections, with volumes and surfaces so different as to make them seem unrelated. By contrast, two well-coordinated sections can only have one corresponding plan. The point here is to underscore the primary importance of the sectional view since in this drawing the shapes and surfaces of spaces can be determined with closer correspondence to the built world than is possible in the plan. Many experienced designers begin not in the plan, but in section.

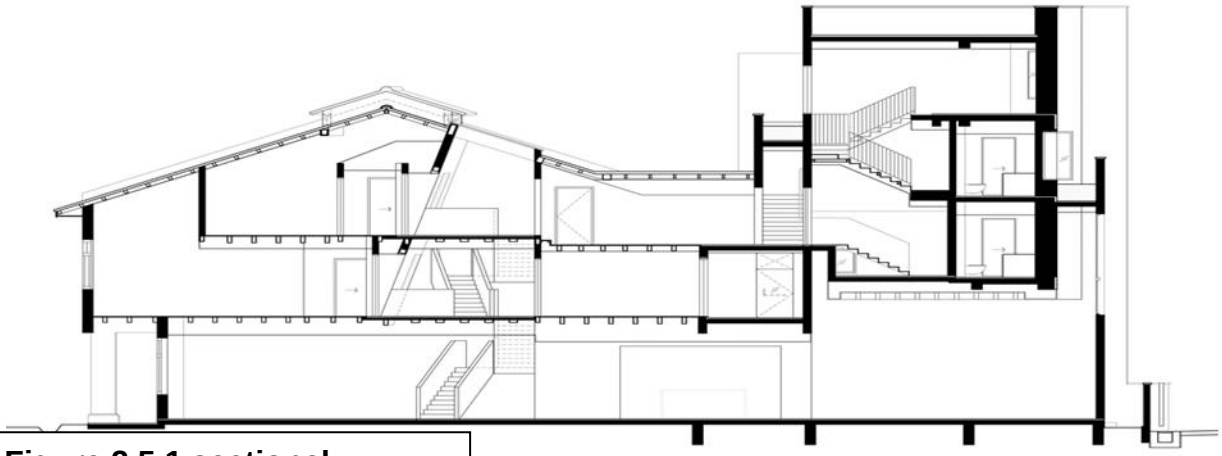


Figure 2.5.1 sectional

A building section, a section drawing, section or a sectional drawing is known by all these different names but basically, presents the view of a building's structure in a way that it looks like it had been cut and sliced in half along an imaginary plane.

The Plan drawings used in architecture are actually one of the types of building section that have been cut through by a horizontal plane rather than a vertical one and shows details accordingly.

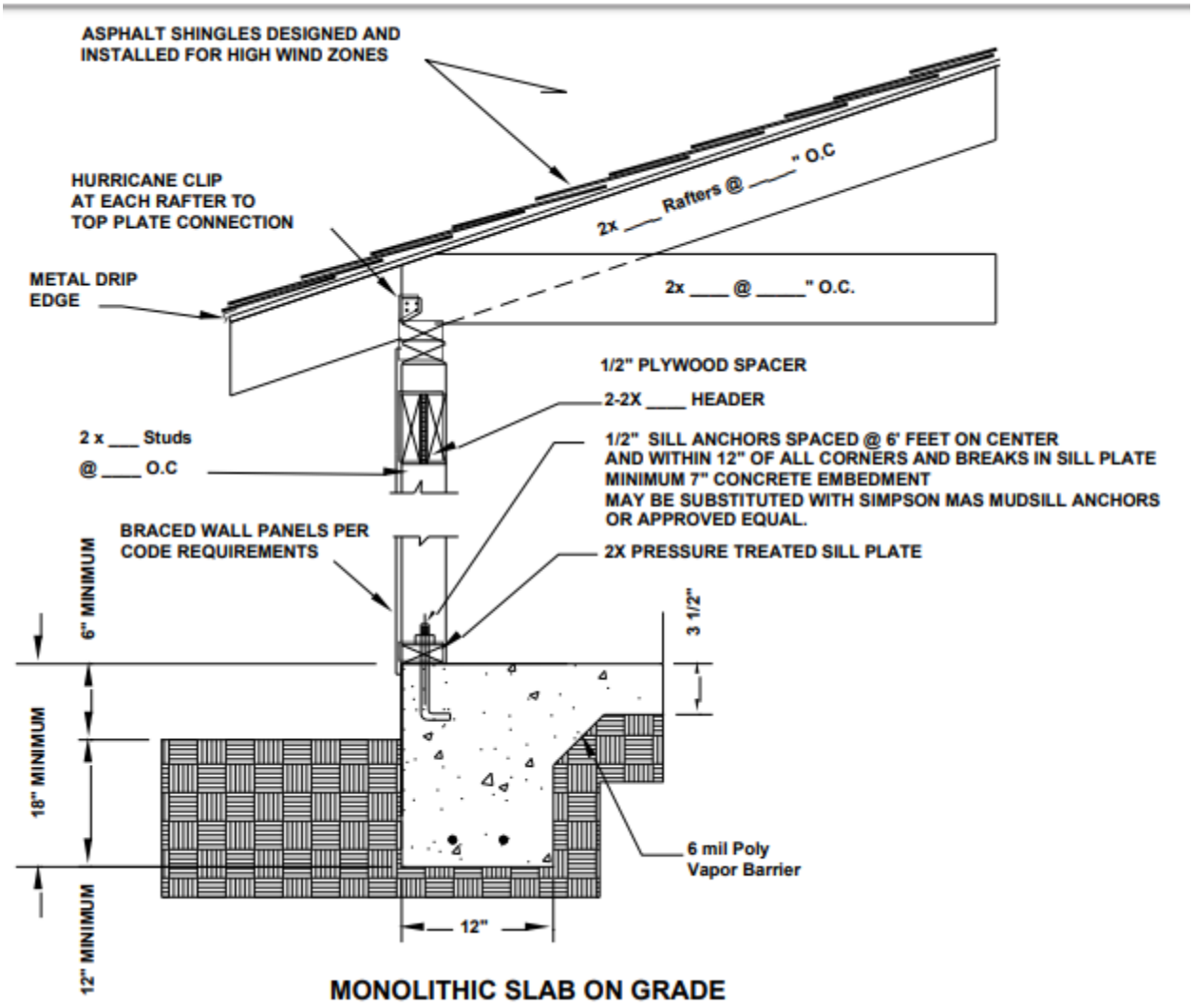


Figure 4.2. Typical building section detail

The important parts of an ordinary building are shown in **Figures 3.3**

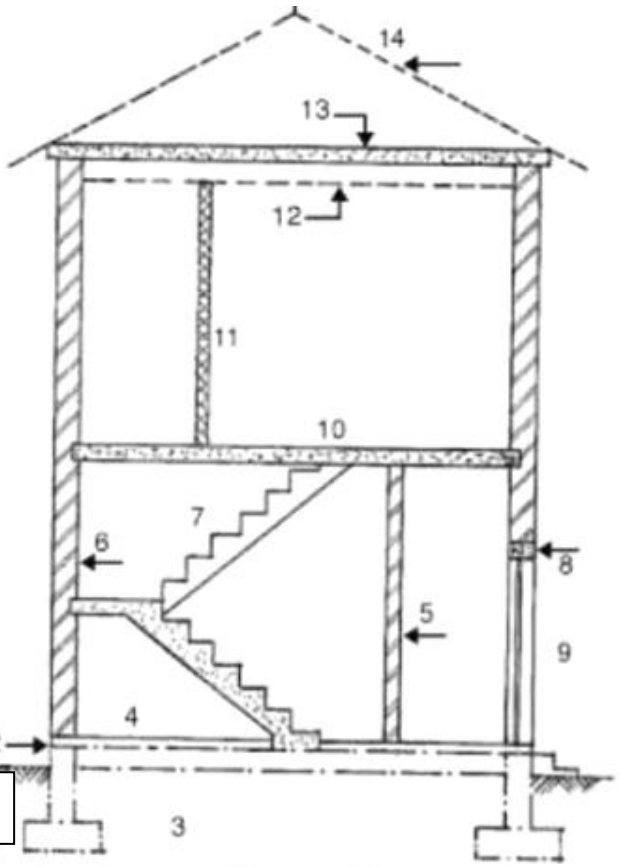


Figure2.5.2

Parts of a building: 1. Foundation, 2. Plinth, 3. Basement filling, 4. Ground floor, 5. Internal wall, 6. External wall, 7. Staircase, 8. Lintel, 9. Door, 10. Upper floor, 11. Partition wall, 12. Ceiling, 13. Flat roof, 14. Sloping roof.

Line drawings

The most typically drawn section is the line drawing which, while fast to execute and easy to modify, is not the most powerful presentation drawing. It tends to use the same convention (i.e., of undifferentiated white space) for both built solid and inbuilt void, creating a poor figure-ground contrast. Of course, certain graphic techniques can help to address this problem.

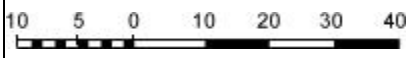
Elements cut in the section can be drawn with a heavy line weight, while elements seen in elevation beyond are drawn much lighter. If properly handled, this system can greatly reduce the problems of figure-ground and can bring depth clues into an otherwise flat drawing.

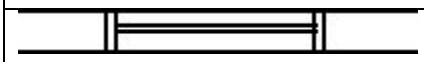
2.6. Common symbol and abbreviations for technical drawing

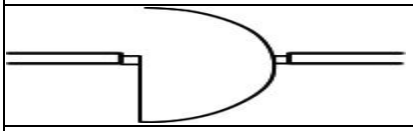
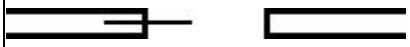
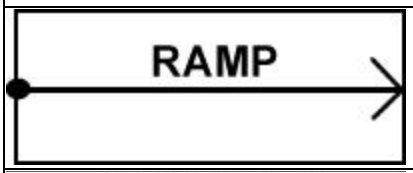
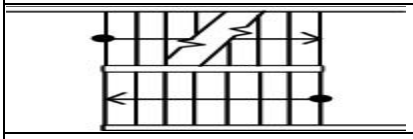
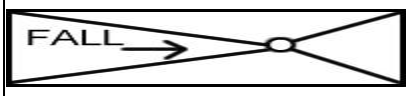
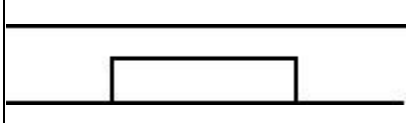
Drawing abbreviations and symbols are used to communicate and detail the characteristics of an engineering drawing. This list includes abbreviations common to the vocabulary of people who work with engineering drawings in the manufacture and inspection of parts and assemblies.

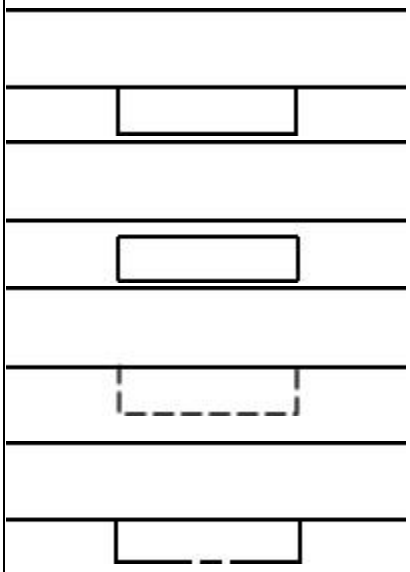
Technical standards exist to provide glossaries of abbreviations, acronyms, and symbols that may be found on engineering drawings. Many corporations have such standards, which define some terms and symbols specific to them

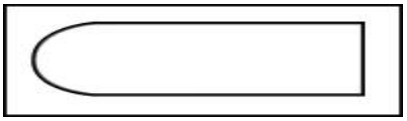
Table 2.6 Symbols

SYMBOL	MEANING
	**Job datum level** - indicates the altitude at a specific point, relative to a universal reference point known as a 'datum'.
	**Window and door references** - a reference to specific window and door diagrams (numbers indicate which diagrams
	**Graduated scale** - used to indicate the size and scale of objects and structures in the diagram
	**Compass** - shows the orientation of the plan diagram and the structures it depicts
	**Title block** - provides details about the project, the specific plan revision you're looking at, the architect or designer, the date etc.

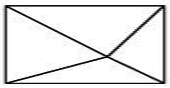
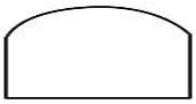
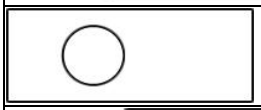
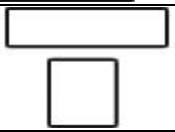
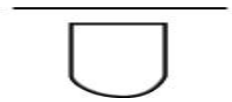
SYMBOL	MEANING
	Window

	**Single-swing door (180 degrees**
	**Single-swing door (90 degrees)**
	**Single double-acting door**
	**Pocket / cavity door** - a sliding door that slides into the wall cavity
	**Exposed sliding door**
	**Bifold / concertina doors centered on a track** **Bifold / concertina doors fixed to one side on a track**
	**Ramp** - arrow points upwards
	**Stairs** - arrow points upwards
	**Fall / drainage** - arrow points downwards, towards floor waste / drain.
	**Archway** **Lintel**
	**Access hatch** **Recessed object** - an object recessed into a particular wall or surface.

	**Surface-mounted object** - an object mounted directly on a wall or surface. **Free-standing object** - an object not connected to the adjacent wall or surface. **Object mounted over** - an object mounted over the area shown. **Object sitting above the plane of the depicted section** - a surface mounted object sitting higher than the plane of the diagram.



Bathtub

	**Shower stall** - lines in the center of this diagram indicate drop for drainage.
	**Basin**
	**Vanity with basin**
	**Toilet**
	**Bidet**

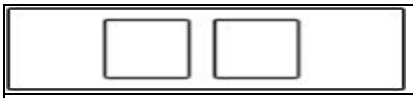
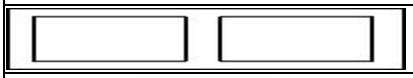
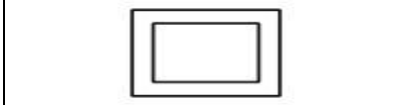
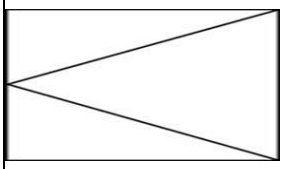
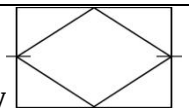
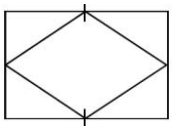
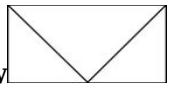
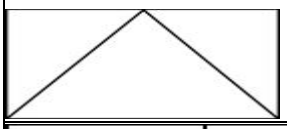
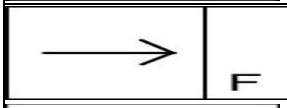
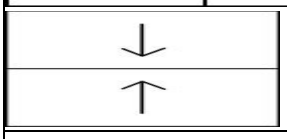
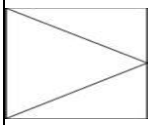
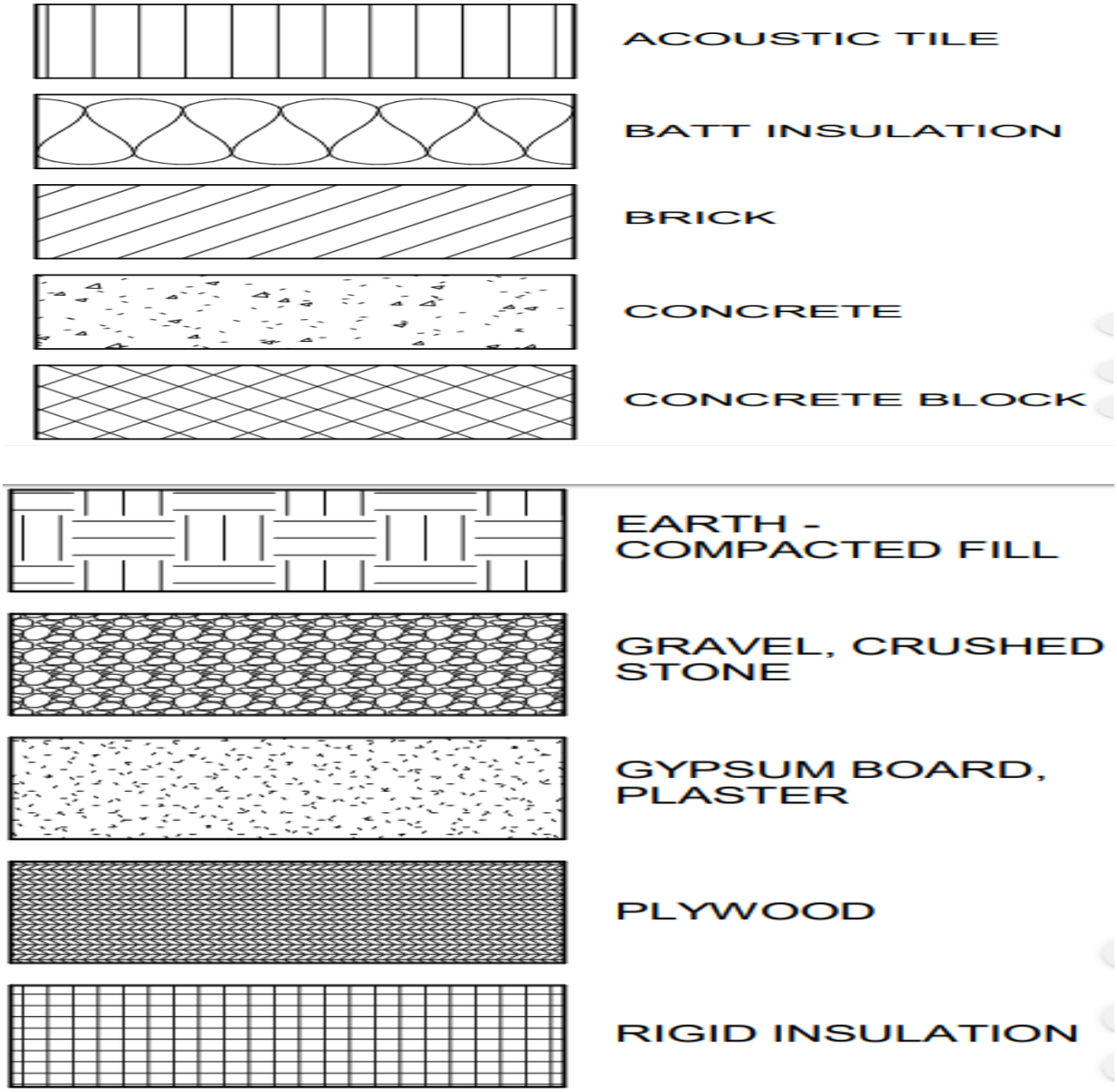
	**Sink with two bowls**
	**Sink with one bowl**
	**Double tub or trough**
	**Single tub or trough**
	**Hotplates**

Table2.6.1 Elevation view - doors and windows

SYMBOL	MEANING
	**Right-side hinged window**  **Side pivoted window**
	**Top and bottom pivoted window**  **Top hinged**
	**Bottom hinged window**
	**Horizontal sliding window with fixed sash**
	**Vertical sliding sash window**
	**Left hinged door**

SYMBOL	MEANING



- Abbreviations

The following abbreviations are used in these Specifications.

Table 2.6.2.1 abbreviation

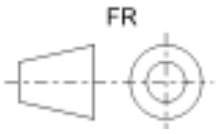
ABBREVIATIONS	
ACOUSTICAL CEILING TILE	
ABOVE FINISHED FLOOR	
ALUMINUM	
AMERICAN NATIONAL STANDARDS INSTITUTE	
ARCHITECTURAL, ARCHITECT	
AMERICAN SOCIETY FOR TESTING AND MATERIALS	
BOARD	
BASE LINE	
BUILDING	
BEAM	
BOTTOM	
BEARING	
BUILT UP ROOF	
CONTROL JOINT	
CENTER LINE	
CEILING	

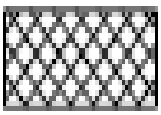
ABBREVIATIONS	
RCP	REFLECTED CEILING PLAN
RD	ROOF DRAIN
REF	REFERENCE, REFRIGERATOR
REINF	REINFORCING
REQD	REQUIRED
REV	REVERSE, REVISED, REVISION
RHR	RIGHT HAND REVERSE
RL	ROOF LADDER
RM	ROOM
RO	ROUGH OPENING
RTU	ROOF TOP UNIT
RWC	RAIN WATER CONDUCTOR
RWL	RAIN WATER LEADER
SCHED	SCHEDULE
SECT	SECTION
SF	SQUARE FOOT / FEET
SGL	SINGLE
SHT	SHEET

Self check-2

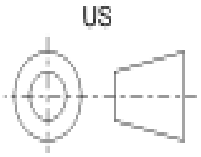
Directions: Answer all the questions listed below.

_____1. One of the following is the symbol of third angel projection?(3 points)

A. 

b. 

c.

D. 



E .all

_____2. A building can be divided into;-(1 points)

A. Substructure **C.** Supers structure

B. Roof structure D. A and B are correct

_____3. is a line drawn around the inside edge of the paper

A. Board line C. Title blocks

B. B. Drawing board C. D. All

_____4. is normally drawn at the bottom of the paper.

A. title blocks C. Drawing sheet

B. drawing space D. Board line

_____5. Which one of the following Steps in completing a drawing(2 points)

A. Select necessary views. C. Erase unwanted construction lines.

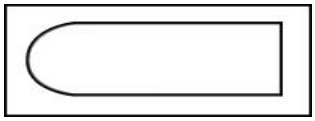
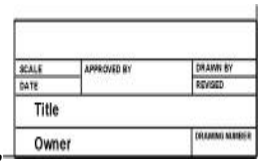
B. Block in lightly the shape of the object. D. All are correct

_____6. Which one NOT Rules for Sketching(2 points)

A. Freehand lines are rough, not rigid. C. A soft pencil should be used

B. Line contrast should be used. D. None

Matching

A	B
1. Ordinary Portland cement	A. 
2. Quantity	B DWG,
3. Titles block	C. 
4. Drawing	D. QTY or qty
5. Exposed sliding door	E , 
6. Bath tub	F OPC

Directions: Answer all the questions listed below.

1. Write and explain the two types of Orthographic projections? (**3 points**)
2. Sketching an oblique cube.(**6 points**)

   Write Types of grids available for freehand sketching

Note: **Satisfactory rating - 3 out of 6 points Unsatisfactory - below 3 out of 6 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Operation sheet 2.1:sketches orthographic drawings and sectional views

Techniques for creating simple sketches, orthographic drawings and sectional views:

Procedure:-

Step1: Prepare drawing instruments and materials

Step 2: Clean the drawing table surface.

Step 3: Properly attach drawing paper on the drawing board

Step 4: Prepare drawing boarder line and title block

Step 5: Draw the given drawing without instrument by free hand sketch based on First problem

Step 6: Draw the given drawing with proper instrument based on second problem

Step 7: clean the drawing workshop room

Lap Test-3 Practical demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks with in **7** hour.

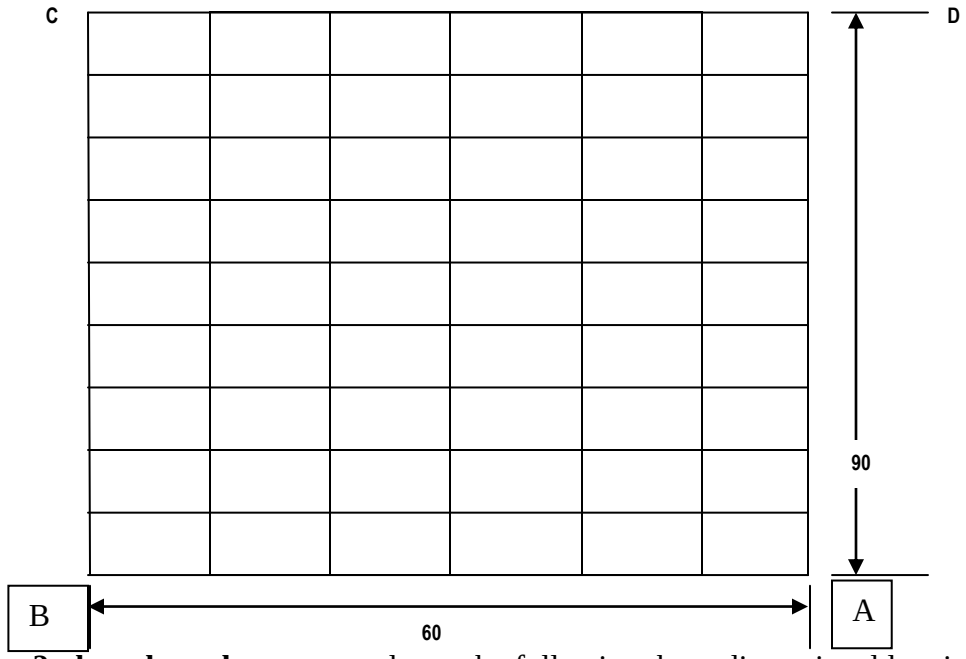
Task 1Prepare drawing boarder line and title block

Task 2draws free hand sketch drawing

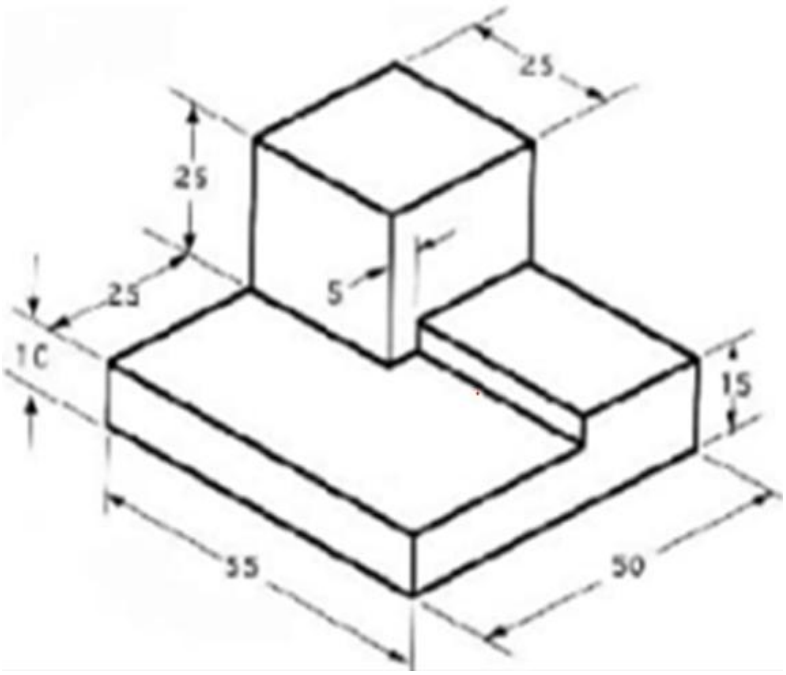
Task 3draws orthographic projection drawing

Pr**oblem 1:**based on above steps sketch under the given questions and drawing with visual estimate.

- Line A-B is divided into 6 equal parts.
- Line A-D is divided into 9 equal parts.



❖ **Problem- 2 based on above steps** draws the following three-dimensionaldrawing changes to orthographic Projection drawing by first angle projection



NOTE: - All measurements are in “mm”

Unit Three: develop specification

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Specifications of building drawings.
- Elements of specifications.
- Specification of construction projects

This guide will also assist you to attain the learning outcomes stated in the unit. Specifically, upon completion of this learning guide, you will be able to:

- Identify purpose of specifications according to workplace procedures.
- Identify suitable elements of the specifications and use for construction project
- Draft specification for construction project using correct format and convention

3.1. Identify purpose of technical drawing specifications

3.1.1 Purpose of specification

A specification is a detailed description of the goods and/or services required and forms part of an invitation to supply or invitation for expressions of interest document. The cost of a unit quantity of work is governed by its specification.

A work is carried out according to its specification and the contractor is paid for the same. Any change in specification changes the tendered rate.

The necessity of specification is to verify and check the strength of materials for a work involved in a project.

Specification is an essential contract document and is required for Arbitration or court cases.

Specification is necessary to specify the equipment, tools and plants to be engaged for a work and thus enables to procure them before hand.

A professional specification should include:

•clear, concise requirements

• functional and performance terms only, unless specific technical requirements are needed

• enough information for vendors to be able to appropriately determine and cost the goods or services that they will offer, and to what level of quality.

3.1.2 Principles of specifications:

Description of materials: The quality and size of materials required to do an item of work shall be fully described for checking up at site according to the bindings provided in the specification.

Workmanship: Complete description of workmanship, the method of mixing to the proportion, the method of laying, preparation of base or surface, compaction, finishing and curing etc. Specifically applicable to the item of work shall be clearly stated in different clauses.

Tools and plants: The tools and plants to be engaged to carry out a work shall be described. The method of operation and by whom to be supplied shall be stated.

Protection of new work: The method of protection of new works against damage or the method of curing if required, the test of completed work if necessary shall be described in separate clauses

Expression: While writing a specification endeavor shall be made to express the requirements of the specification clearly and in concise form avoiding repetition and unusual words. The style of tense shall remain same throughout.

Clauses of specifications: As far as possible, the clauses shall be arranged in the order in which work shall be carried out. This does not mean to follow the works according to the order of arrangements but it facilitates reference. While framing clauses for quality of materials, workmanship, tools and plants etc. Practical possibilities shall be realized

Drawing specifications the sole function of working drawings is to convey the intention of the designer, so far as drawings are capable of doing this. They must be accurate and legible before everything else. They are part of the contract documents of the building contract and should always be prepared with the realization that they are legal documents.

3.1.2 Two Types of drawing are used

Design or sketch drawings that set down ideas on room relationships, room sizes, the orientation of the house, the stylistic treatment of the house, color schemes, possible furniture layout and landscaping ideas.

Working drawings or construction drawings that show the finalized design. They indicate the exact arrangement of spaces, their sizes, the materials of construction and specific details so as to enable the building of the house.
The drawings must be clear and perfectly legible to everyone who needs to work from them. To ensure this, the terms, abbreviations, symbols and other conventions used must be commonly understood.

3.2. Identify the elements of technical drawing

3.2.1 elements of specification

Survey Plan - Usually produced by a surveyor

a. Existing site and surroundings.

B. Position of major natural features, trees, ponds, rock outcrops.

C. Sufficient spot levels and contour lines related to a specified datum (height above sea level).

D. Dimensions of boundaries.

E. Position of roadways, easements; existing drains and possibly service mains.

Site Plan

a. Outline of site boundaries showing location of proposed building

b. Position of boundary setbacks.

C. Depths, where they may occur.

D. New roads and pathways

e. Soil and surface water drains, complete with pipe sizes

f. Service runs from the house to mains.

G. Location of utility services (sewer, water, gas, electricity)

h. The point of connection of those services to the house itself

i. Indication of banking and cutting and areas for depositing and spreading surplus soil.

J. New levels on the site in connection with the new house.

K. Landscaping. Note, if the site is undulating or steep, section should be added to show principle **Areas of cutting and filling. They may also include:**

a. Real property description and lot number, etc.

B. North direction indicated

c. Street position and owners‟ name

d. Contours and levels

e. Driveway.

Floor plan

a. Dimensions of overall brickwork, stud framing and room sizes to rough stud frames. Trim openings of all windows and doors.Space allowance for refrigerator and white goods. Wardrobe depths. Location and spacing of all columns and verandah posts.

B. Roof and eave lines as dashed lines

c. Doors and windows to have a legend reference describing the details of each.

D. Internal dimensions so far as necessary to establish positions of internal walls or fittings

e. Thickness of walls

f. Door swings

g. Windows

h. Location of fittings and fixtures

i. Names on all rooms

j. Floor finishes

k. Position of stairs and number of stair treads

Sections and elevations

a. Elevations of all parts of the building.

B. Size and shape of openings.

C. External finishes.

D. New and old ground levels showing cut and fill

e. Position of floor level, ceiling level

f. Positions of all windows and doors

g. Heights of ceilings, doors and windows above the floor surface can be marked here.

H. Dashed lines indicating positions of external wall bracing (optional on elevations but good practice).

I. Dashed lines indicating natural ground lines (this will enable more accurate calculating of materials below floor level).

J. Roof and wall claddings and finish.

K. Types of glass selected for specific windows and doors.

L. Roof vents, air conditioning units, and solar locations

Other plans used either where requested or for more complex houses.

A. Footing plan

(i) width and depth of all footings to wall, piers, and stanchions.

(ii) Location of footing system

(iii) position and levels of drains and gulley's close to footings

(IV) walls above footings with thickness noted.

B. Roof plan

(i) shape of roof

(ii) slopes of levels

(iii) types of coverings

(iv) falls to gutters and gutters

(v) roof lights

(vi) possible type of construction. Note, on simple houses the roof plan is super imposed over the floor plan

C. **Services plan** showing the arrangement of:

(i) electrical layout

(ii) plumbing and internal drainage layouts.

(iii) Air-conditioning or other mechanical services.

Note – on simpler houses the electrical layout and plumbing layouts are superimposed on the floor plan.

Material specifications

these cover the type and quality of each material required in the project together with its treatment and testing by the supplier.

Workmanship specifications:

These cover the use of these materials in the project, their fabrication into the structure, the method and order of their installation, the quality of labor to be employed, the standard of workmanship required, and the tolerances permitted.

Machinery specifications:

These cover the capacity, performance, and operation of all permanent plant to be installed under the contract, and the commissioning tests necessary to demonstrate its adequacy.

Design specifications:

These are necessary when structural or other engineering design forms part of any contract. Hence the full criteria governing the design and safety of the works should be precisely defined, together with the owner's requirements for submission of detailed specifications, and so on.

3.3. Using correct specifications for construction building

3.3.1 specification for constriction

Specifications describe the materials and workmanship required for a development. They do not include cost, quantity or drawn information, and so need to be read alongside other information such as quantities, schedules and drawings. Specifications vary considerably depending on the stage to which the design has been developed, ranging from performance specifications (open

specifications) that require further design work to be carried out, to prescriptive specifications (closed specifications) where the design is already complete.

3.3.2 Job Description and Job Specification

Job Analysis is a primary tool to collect job-related data. The process results in collecting and recording two data sets including job description and job specification. Any job vacancy cannot be filled until and unless the manager has these two sets of data. It is necessary to define them accurately in order to fit the right person at the right place and at the right time. This helps both employer and employee understand what exactly needs to be delivered and how.

Both job description and job specification are essential parts of job analysis information. Writing them clearly and accurately helps organization and workers cope with many challenges while onboard.

3.3.2.1 Job Description

Job description includes basic job-related data that is useful to advertise a specific job and attract a pool of talent. It includes information such as job title, job location, reporting to and of employees, job summary, nature and objectives of a job, tasks and duties to be performed, working conditions, machines, tools and equipment to be used by a prospective worker and hazards involved in it

3.3.2.2 Purpose of Job Description

The main purpose of job description is to collect job-related data in order to advertise for a particular job. It helps in attracting, targeting, recruiting and selecting the right candidate for the right job.

It is done to determine what needs to be delivered in a particular job. It clarifies what employees are supposed to do if selected for that particular job opening.

It gives recruiting staff a clear view what kind of candidate is required by a particular department or division to perform a specific task or job.

It also clarifies who will report to whom.

3.3.2.3 Job Specification

Also known as employee specifications, a job specification is a written statement of educational qualifications, specific qualities, level of experience, physical, emotional, technical and

communication skills required to perform a job, responsibilities involved in a job and other unusual sensory demands. It also includes general health, mental health, intelligence, aptitude, memory, judgment, leadership skills, emotional ability, adaptability, flexibility, values and ethics, manners and creativity, etc.

3.3.2.4 Purpose of Job Specification

Described on the basis of job description, job specification helps candidates analyze whether are eligible to apply for a particular job vacancy or not.

It helps recruiting team of an organization understand what level of qualifications, qualities and set of characteristics should be present in a candidate to make him or her eligible for the job opening.

Job Specification gives detailed information about any job including job responsibilities, desired technical and physical skills, conversational ability and much more.

It helps in selecting the most appropriate candidate for a particular job.

Job description and job specification are two integral parts of job analysis. They define a job fully and guide both employer and employee on how to go about the whole process of recruitment and selection. Both data sets are extremely relevant for creating a right fit between job and talent, evaluate performance and analyze training needs and measuring the worth of a particular job.

Self check-3

Directions: Answer all the questions listed below.

7. What is the purpose of specification.

8. Explain two types of drawings.

9. List Principles of specifications

10. List and explain elements of specification

11. Write the difference b/n job distributions and job specification.

List of Reference Materials

- *ASME (2007), Y14.38–2007: Abbreviations and acronyms for use on drawings and related documents, ASME.*
- *French, Thomas E.; Vierck, Charles J.; et al. (1953), A manual of engineering drawing for students and draftsmen (8th ed.), New York, New York, USA: McGraw-Hill*
- Building Construction Handbook' (6th ed.), CHUDLEY, R. and GREENO, R., Butterworth-Heinemann (2007

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