GPCET
Pioneering Innovative Education

G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY
Accredited by NAAC with 'A' Grade of UGC, Approved by AICTE, New Delhi
Permanently Affiliated to JNTUA, Ananthapuramu
(Recognized by UGC under 2(f) and 12(B) & ISO 9001:2008 Certified Institution)
Nandikotkur Road, Venkayapalli, Kurnool – 518452

Department of Mechanical Engineering

Bridge Course
On
Engineering Drawing for Mechanical Engineers

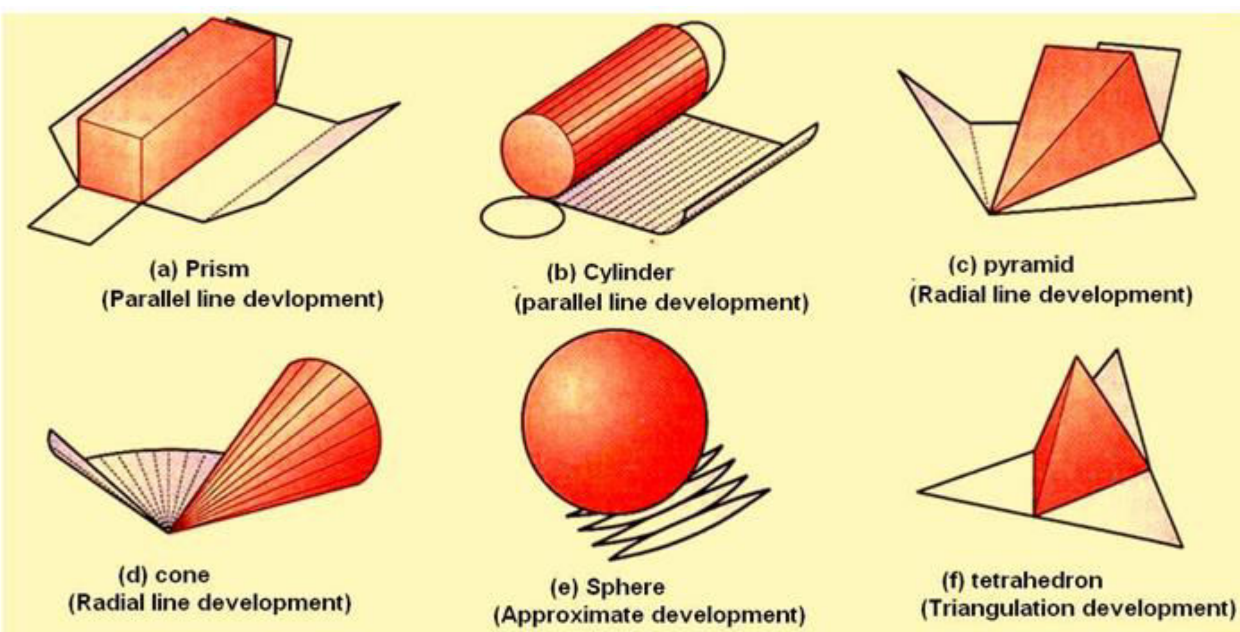
UNIT -1 Sections and Developments of Solids

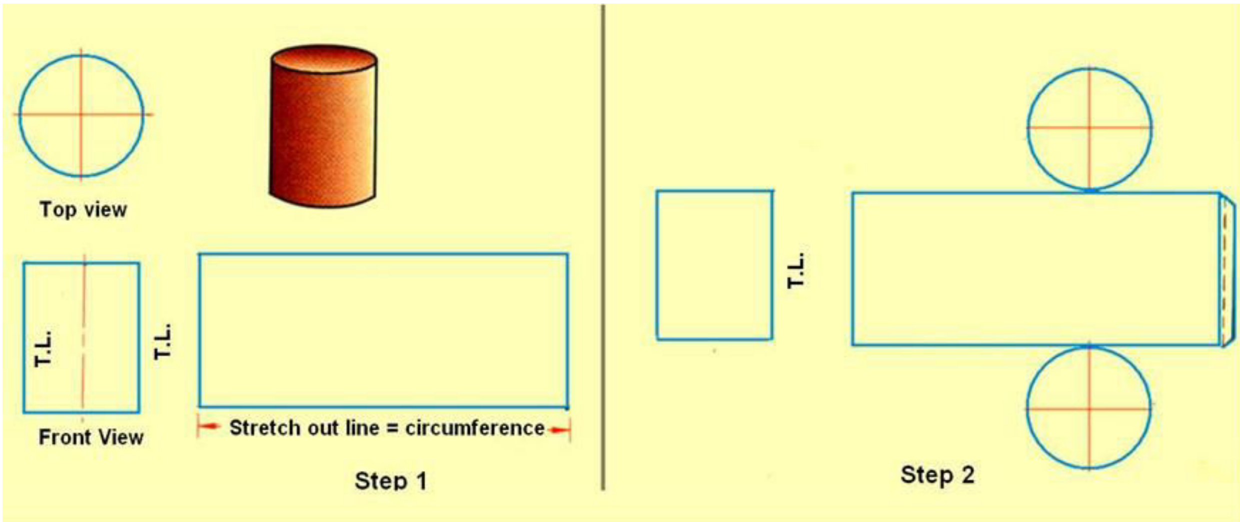
Types of Development

1. **Parallel line development**: In this parallel lines are used to construct the expanded pattern of each three-dimensional shape. The method divides the surface into a series of parallel lines to determine the shape of a pattern.
2. **Radial line development**: In this, lines radiating from a central point to construct the expanded pattern of each three-dimensional shape is used. These shapes each form part of a cone and lines radiating from the vertex of the cone generate the expanded pattern of the curved surface as shown in the following explorations.
3. **Triangulation method**: This is generally used for polyhedron, single curved surfaces, and warped surfaces.
4. **Approximate development**: In this, the shapes obtained are only approximate. After joining, the part is stretched or distorted to obtain the final shape

<u>Important points</u>

1. Parallel line method is used for development of Prisms and cylinders.
2. Radial line method is used for development of Pyramids and cones.
3. For cone, the angle of arc is =360xRadius of base circle/ slant length.





Sections

Introduction

In engineering industries, when the internal structure of an object is complicated, it is very difficult to visualize the object from its orthographic views since there will be several hidden lines. In such case, the internal details are shown by sectional views. Sectional views are an important aspect of design and documentation since it is used to improve clarity and reveal interior features of parts.

Sectional drawings are multi-view technical drawings that contain special views of a part or parts, that reveal interior features. A primary reason for creating a section view is the elimination of hidden lines, so that a drawing can be more easily understood or visualized. Traditional section views are based on the use of an imaginary cutting plane that cuts through the object to reveal interior features. This imaginary cutting plane is controlled by the designer and are generally represented by

(a) Full section view, where the section plane go completely through the object.
(b) Half section view, where the section plane go half-way through the object.
(c) Offset section, where the sectional plane bent through the features that are not aligned.

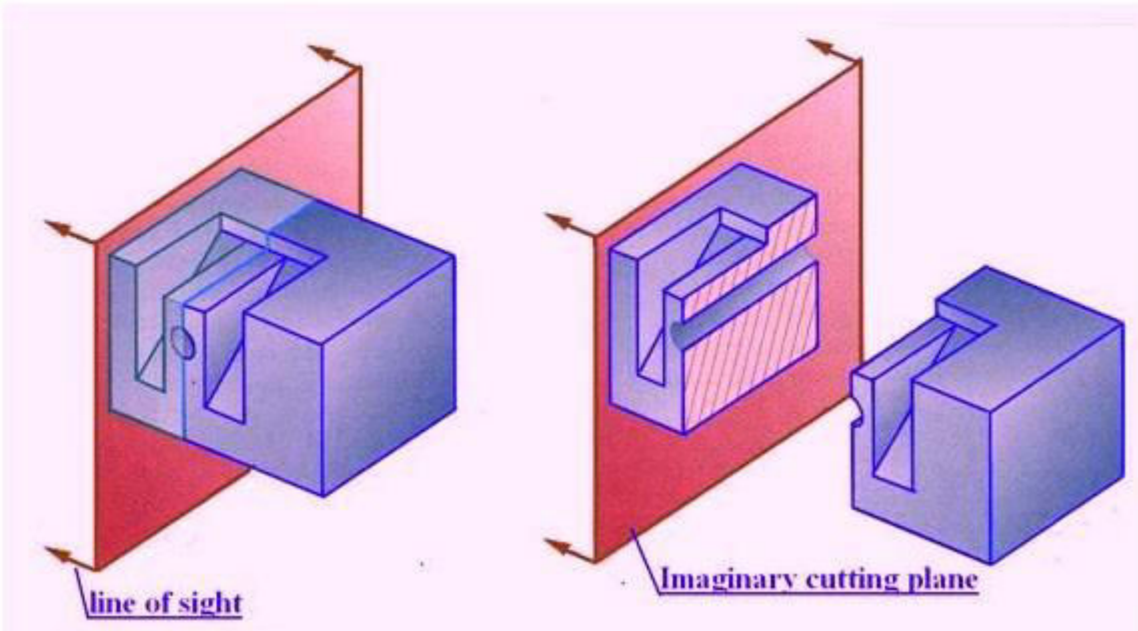


Figure 1. Illustrates a full Section view

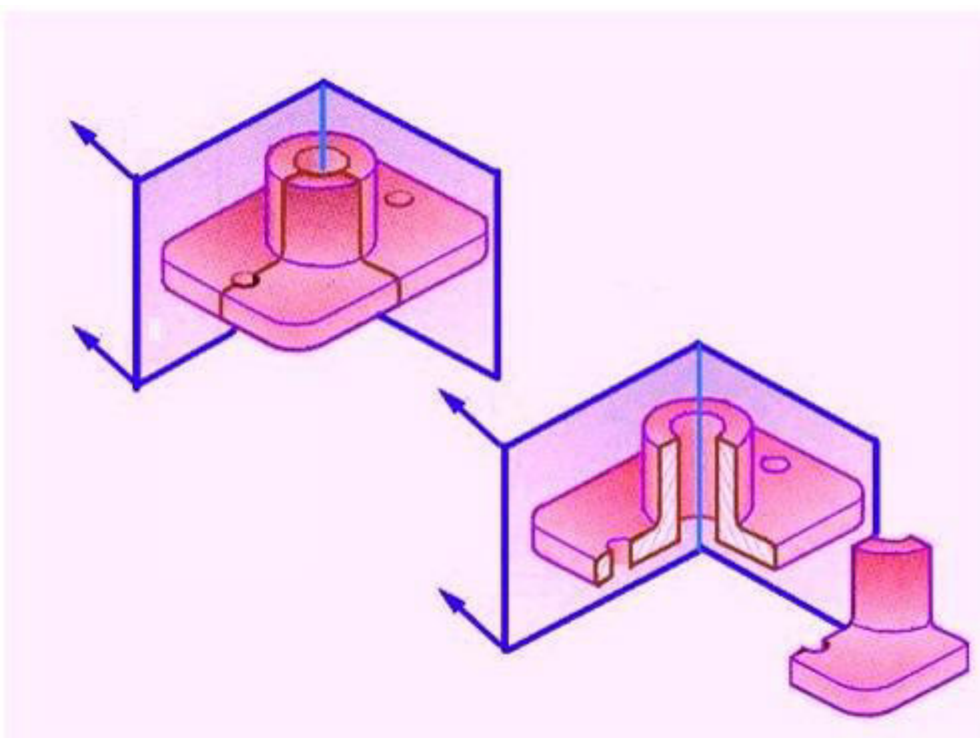


Figure 2. Illustrating a half section view

Unit –II Isometric Projection

Isometric projection is a type of pictorial projection in which the dimensions along the three axes of the solid are shown in one view. It is one of the three types of axonometric projection In axonometric drawing, one axis of space is shown vertical and depending on the exact angle at which the view deviates from the orthogonal, axonometric projections are generally three types: (a) trimetric projection, (b) dimetric projection, and (c) isometric projection.. This is illustrated in figure

1. In trimetric projection, the direction of viewing is such that all of the three axes of space appear unequally foreshortened. The scale along each of the three axes and the angles among them are determined separately as dictated by the angle of viewing. Trimetric perspective is seldom used.
2. In dimetric projection, the direction of viewing is such that two of the three axes of space appear equally shortened, of which the attendant scale and angles of presentation are determined according to the angle of viewing; the scale of the third direction (vertical) is determined separately. When two of the three angles are equal, the drawing is classified as a dimetric projection. Dimetric drawings are less pleasing to the eye, but are easier to produce than trimetric drawings
3. In isometric projection, the most commonly used form of axonometric projection in engineering drawing. Here all three angles are equal. The isometric is the least pleasing to the eye, but is the easiest to draw and dimension.

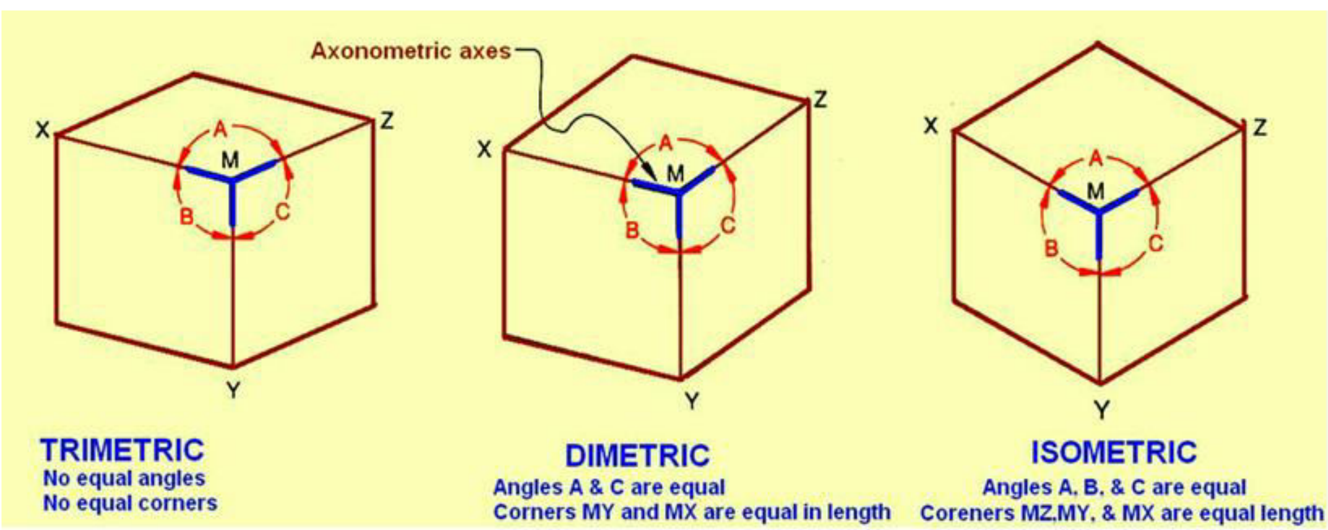
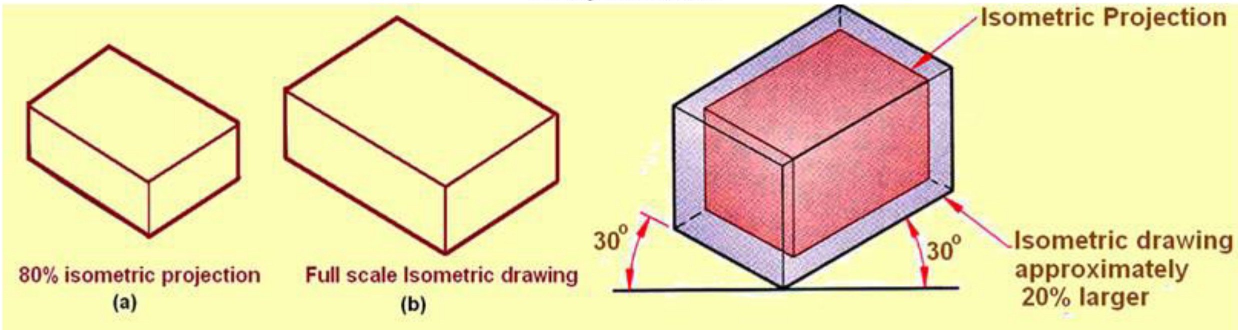
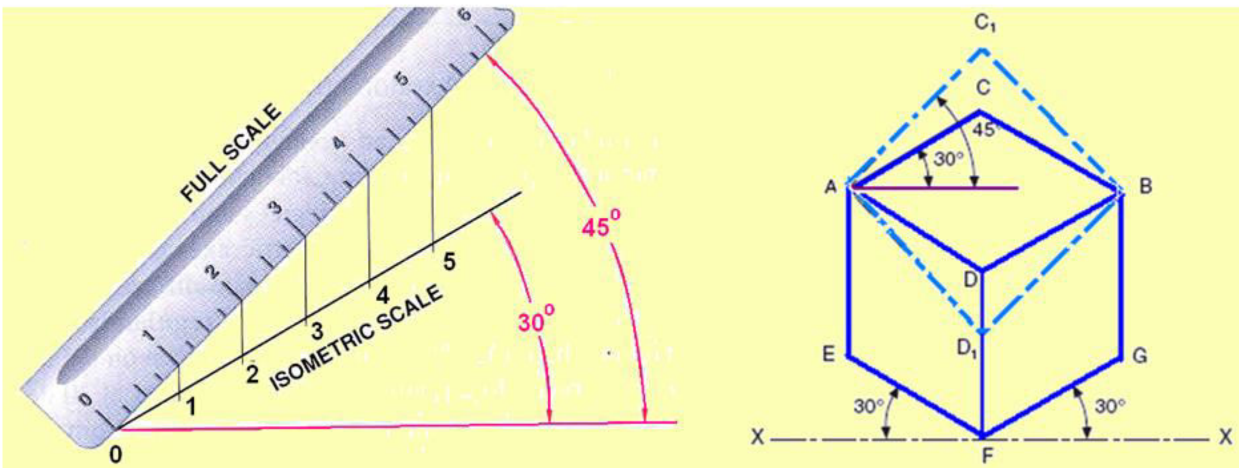
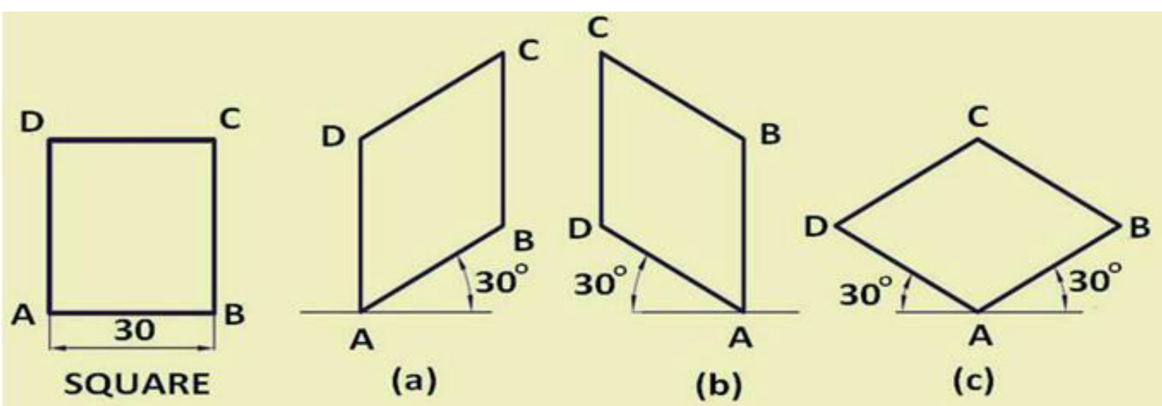


Figure . Shows the three types of axinometric drawing. The angles determine the type of axinometric drawing.



While drawing isometric projection, an Isometric scale is to be constructed for convenience and all the measurements are to be taken from this scale. As shown in figure 5, isometric scale is produced by positioning a regular scale at 45 ° to the horizontal and projecting lines vertically to a 30° line.





Isometric views of a square.

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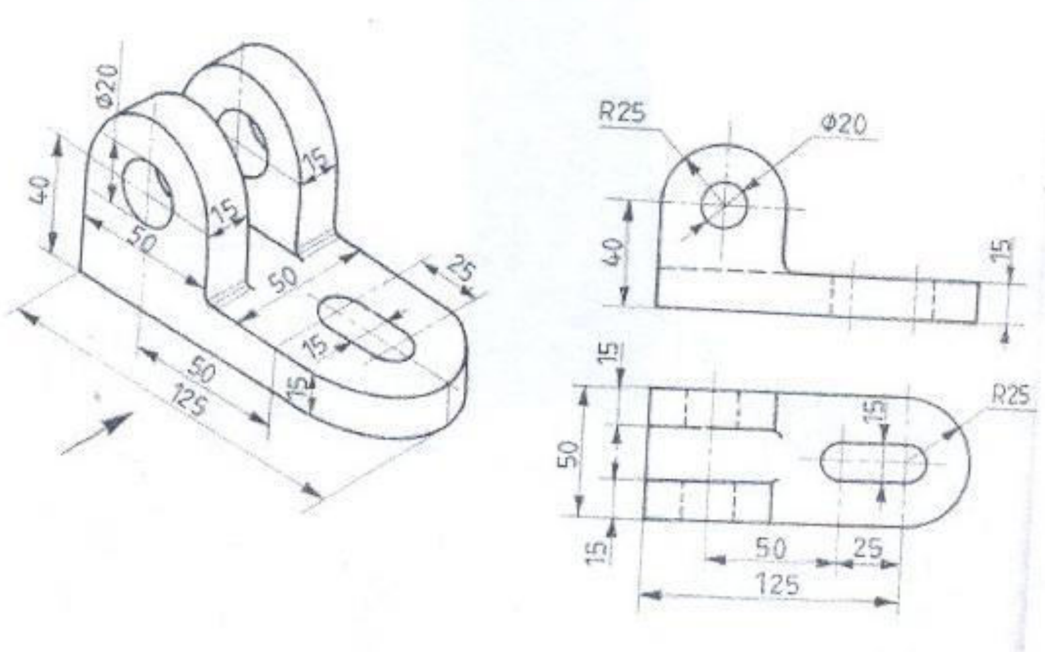
Unit –III Conversion of Pictorial views to Orthographic views

1.



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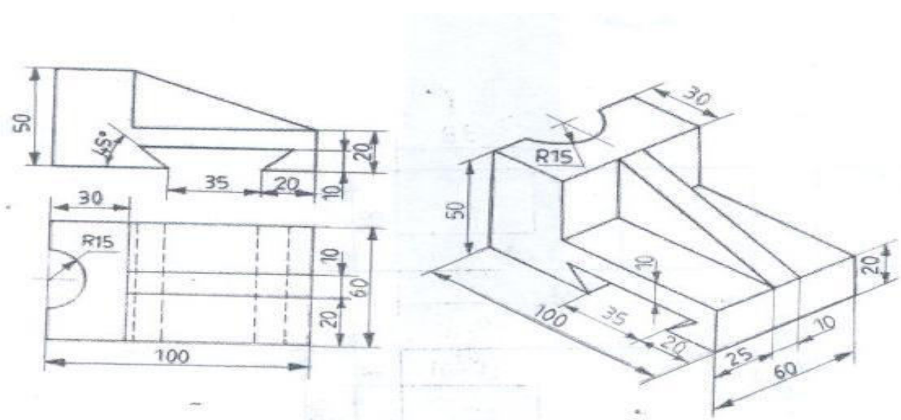
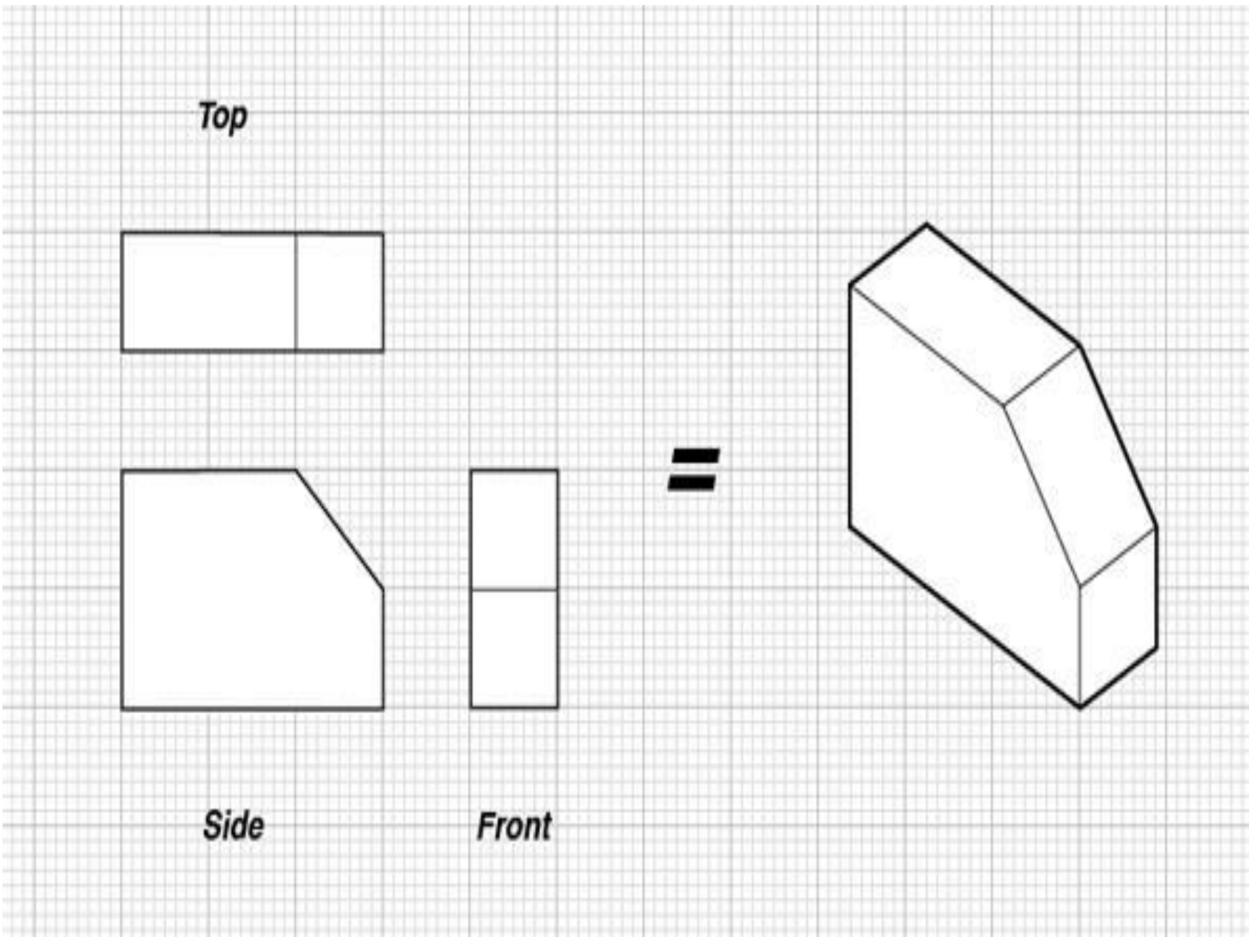


3.



Unit –IV Interpenetration of Right Regular Solids

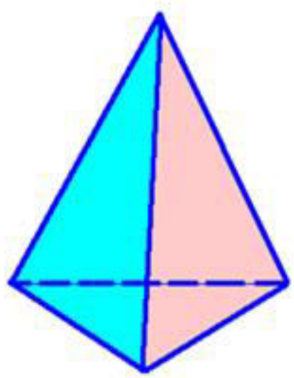
Solid

A solid is a 3-D object having length, breadth and thickness and bounded by surfaces which may be either plane or curved, or combination of the two.

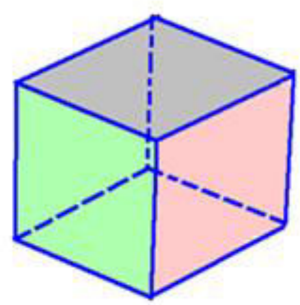
Solids are classified under two main headings

- Polyhedron
- Solids of revolution

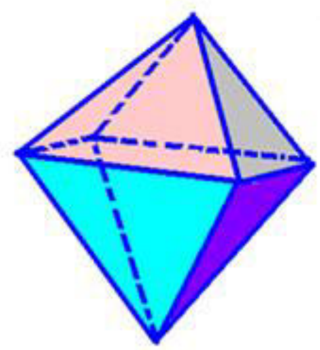
A regular polyhedron is solid bounded only by plane surfaces (faces). Its faces are formed by regular polygons of same size and all dihedral angles are equal to one another. when faces of a polyhedron are not formed by equal identical faces, they may be classified into prisms and pyramids.



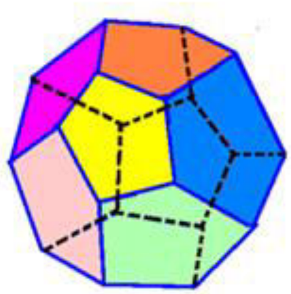
Tetrahedron – four equal equilateral triangular faces



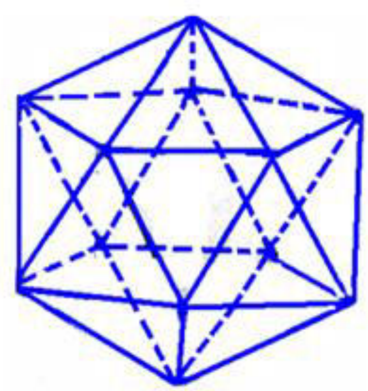
Cube/hexahedron 6- equal squar faces triangular faces



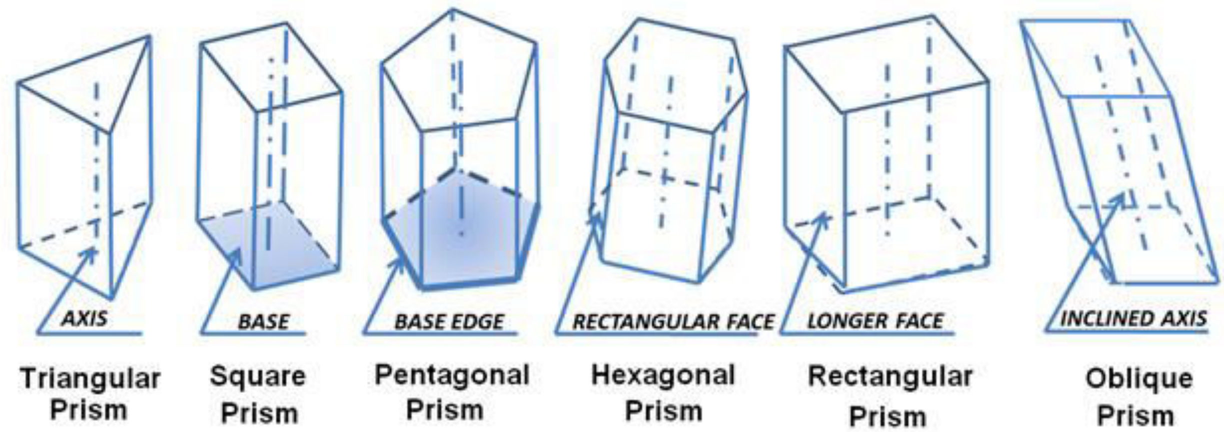
Octahedron– 8 equal equilateral



Dodecahedron – 12 equal regular pentagonal faces

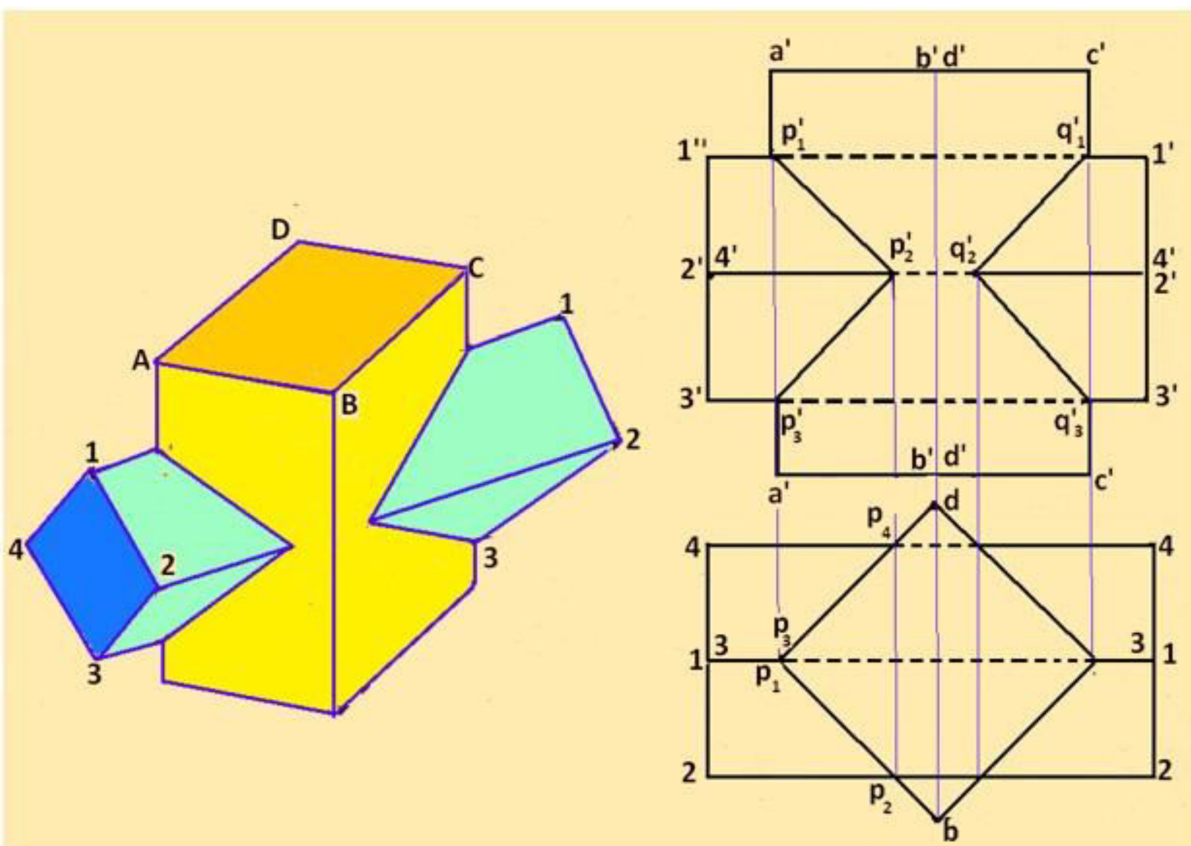


Icosahedron– twenty equal equilateral triangular faces



Intersection of solids

Whenever two or more solids combine, a definite curve is seen at their intersection. This curve is called the curve of intersection (COI). Lines of intersection are a common feature in engineering applications or products. Figure 1 shows few examples of intersection lines frequently observed in chemical plants, domestic appliances, pipe joints, etc. Curves of intersections are important from the point of view of production of components for engineering applications.



Lines of intersection obtained for intersection of square prism and square prism.

Unit –V Perspective Projections

Theory of Projections

In engineering, 3-dimensonal objects and structures are represented graphically on a 2-dimensional media. The act of obtaining the image of an object is termed “projection”. The image obtained by projection is known as a “view”. A simple projection system is shown in figure .

All projection theory are based on two variables:

- Line of sight
- Plane of projection.

Plane of Projection

A plane of projection (i.e, an image or picture plane) is an imaginary flat plane upon which the image created by the line of sight is projected. The image is produced by connecting the points where the lines of sight pierce the projection plane. In effect, 3-D object is transformed into a 2-D representation, also called projections. The paper or computer screen on which a drawing is created is a plane of projection.

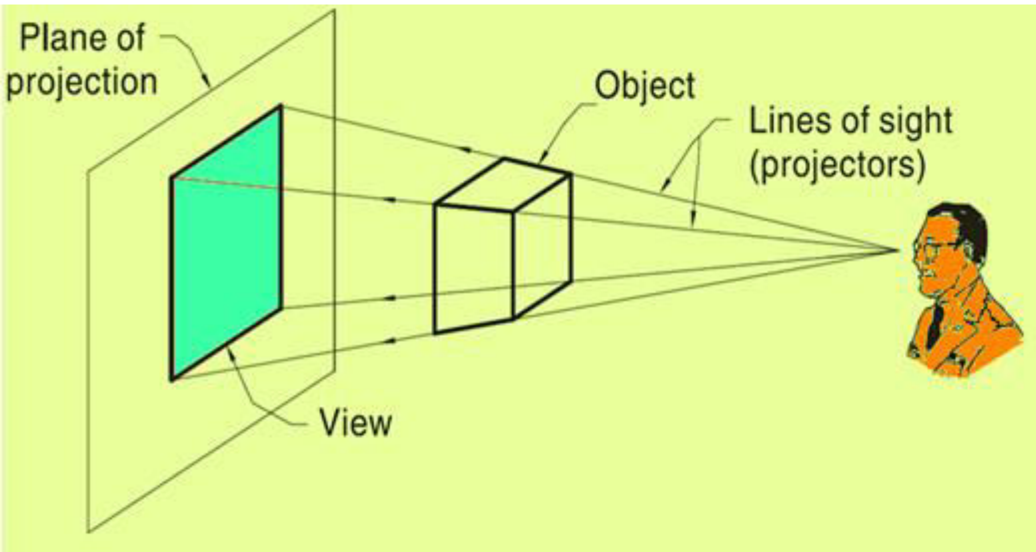


Figure : A simple Projection system

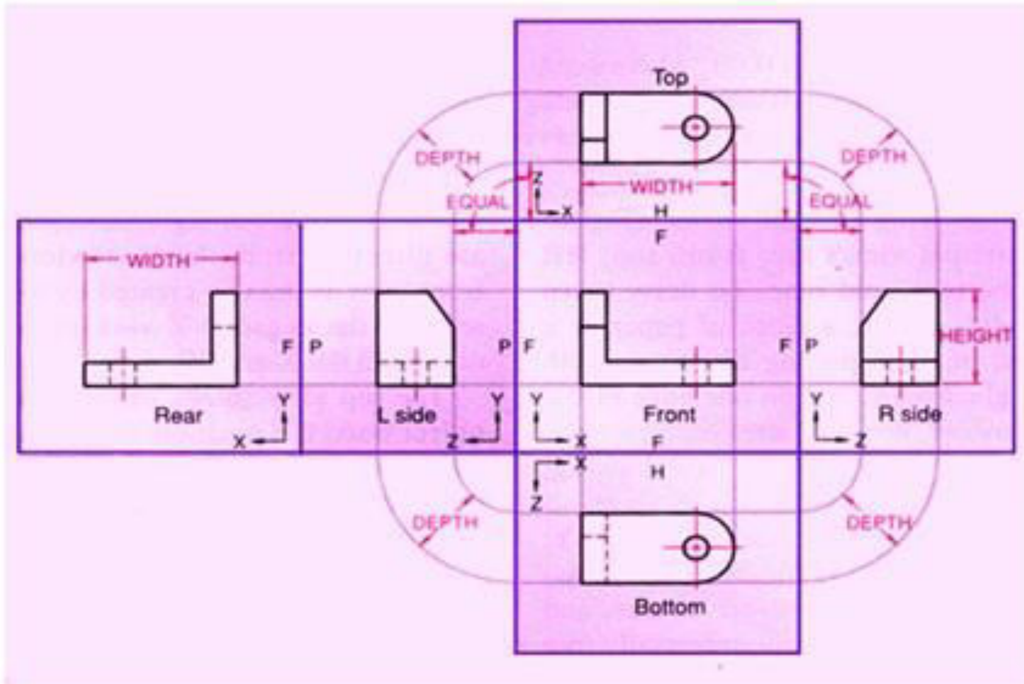


figure shows the views of the object with their relative positions after the box has been unfolded completely on to a single plane.

Perspective Projections

When an object is viewed from different directions and at different distances, the appearance of the object will be different. Such view is called perspective view. Perspective projections mimic what the human eyes see. This is evident from the two photographs shown in figure . In the first photograph, it appears that the height of the building near to the observer is taller than the height of the building farther than the observer though the heights of all these buildings are same. Similarly the width of the road appears to be shortened for the region which is away from the observer, though the width of the road is same along the length. It appears that the two sides of the road may meet at some far away distance from the observer. This is a simple representation of the perspectiveview.

Perspective views are not important for a manufacturing unit. They are used to communicate information to non technical persons. Hence it is very important for commercial purposes. In perspective projection, all lines of sight start at a single point. Distance from the observer to the object is finite and the object is viewed from a single point – projectors are not parallel.

Photograph of (a) buildings and (b) a road as observed by the human eye or a camera