1. INTRODUCTION

2. ISOMETRIC PROJECTION
   Isometric rules
   Position of Object

3. OBLIQUE PROJECTION
   Types of Oblique Projection

4. CIRCLES IN PICTORIAL PROJECTION

   Isometric Circles
   - American Method.
   - American Method for Rounded Corners.
   - Ordinate method.
   - Ordinate Method for Irregular Curves.
   - Diagonal Method.
   - Isometric Drawing of Solid Cylinder.
   - Isometric Drawing of Hollow Cylinders.
   - Isometric Drawing of Step Shafts.

   Circles in oblique projection
   - Compasses Method for Oblique Circles
   - Steps of Construction for Oblique Circles
   - Ordinate Method
   - Correction of Distortion

5. EXAMPLES AND EXERCISES
Introduction

Pictorial projection is a method of giving an instant three-dimensional view of an object, and so it is useful for relaying information to a person not used to reading drawings prepared in orthographic projection. There are two types of pictorial projection in common use, namely:

1. **ISOMETRIC projection**
2. **OBLIQUE projection**

![Cube](Image)

![Rectangular block](Image)

![Hexagonal prism](Image)

**ISOMETRIC PROJECTION**
NOTE:

HIDDEN DETAILS are not usually shown and should not be indicated unless required for some special requirements.

1. ISOMETRIC PROJECTION

Isometric means:  
- Iso = Equal 
- metric = measurement

- In isometric projection, all vertical lines on the object are drawn vertically.
- Horizontal lines are drawn at angle of 30° to the horizontal on each side of the vertical ones.
- Circles are drawn as ellipses.
- An isometric drawing can be done quickly with the aid of the aid of the 60° set-square resting on the tee-square.
- The simplest method of making an isometric drawing of an object having a complicated shape is to enclose the object within an imaginary box, of course, can be easily drawn in isometric projection.
Isometric rules

1. Draw an isometric box having the maximum height, width and depth of the object.

2. Draw in the details.

3. Remove unnecessary details and darken in your drawing.
Position of Object

The position in which the object is tilted and viewed can be donated by any of the following methods:

1) **Lowest point.** The principles of first and third angle orthographic projection must be very clear before starting to answer the problem.
2) **One or two faces to be in the foreground.** One or two faces will be labelled and will be required of face the labelled surface(s) in the foreground.
3) Arrows. This method provides the greatest variations of viewing the project isometrically. Unless treated carefully it could be the most confusing method as each set of arrow only give one specific answer only.
In oblique projection, the front face of the object is drawn to its TRUE shape, as in orthographic projection.

The adjacent sides to the main face are drawn at a common oblique angle, which may be either 30°, 45°, 60° or and are usually drawn at half the full size.

Types of Oblique Projection

There are two types of oblique projection which are used extensively:

1. CAVALIER PROJECTION
   The receding adjacent lines to the true face drawn in full size.

2. CABINET PROJECTION
   The receding lines are drawn half the full size to compensate for distortion and to approximate more closely what human eye would see.
• The cabinet type is preferably used because it gives a natural appearance than the cavalier which is \textit{distorted}.

• Similar to isometric drawing, it is a good practice to use the "box-in" method. One surface of the box will be used as the front elevation. Again, either a large box is used to enclose the whole object or a series of boxes stacked up together.

• Whenever possible, the face of the object having circles or arcs should be selected as the \textit{FRONT} face, so that such circles or arcs can be easily, drawn in their true shape.

• One big advantage of oblique method of projection is that circles and curves on the front face, or on face parallel to it, are not changed and can therefore be drawn with compasses from their true centres.

CIRCLES IN PICTORIAL PROJECTION

1. Isometric Circles (Compasses & Ordinate Method).

Often, circles and curves are needed to be drawn isometrically. Three common methods are used:

   a) American Method.
   b) Ordinate method.
   c) Diagonal Method.

As a simple rule, circles appear as \textit{ellipses} in Isometric.

\textbf{(a) American Method.}

The American Method is a quick and satisfactory method for beginners. However, it has a drawback and that is it does not give a true isometric circle and where accuracy is essential it should not be used.

Steps:

1. An isometric cube of side equal to the diameter of the circle is drawn. The position of the square will depends on where the circle is to be placed.

2. The longest diagonal is joined and C1 and C2 are centres on the shortest diagonal.
3. Two lines are each drawn perpendicularly to an isometric axis from C1. These lines are also at 60° to the base line and they intersect the longest diagonal to obtain C3 and C4.

4. With the four centres, the ellipse can be drawn. However the ellipse drawn has its ends foreshortened as compared to other method.

This method may also be applied to rounded corners of object in a much simplified and faster way. However, it will be difficult to apply to irregular curves

- American Method for Rounded Corners.

**STEPS:**

1. An isometric rectangle is drawn for the relative position of the corner. Mark the radii at each corner along the isometric lines.

2. With a 30°-60° set square lines are drawn at the marked corner perpendicular to the isometric lines to obtain C1 & C2.
3. Using centre C1, radius C1 to marked corner described the arc and similarly for C2.

4. For thickness of object, C1 is produced perpendicularly down and C3, C4 obtained by marking the thickness H.

5. Complete the isometric box and arcs are similarly drawn.

(b) Ordinate Method

This is the most accurate method. However it can also be the slowest of the three.

STEPS:

1. An isometric square of side equal to the circle diameter is drawn as before depending on the position of the circle.

2. Another similar square is drawn as an auxiliary view with a circle Inscribed. Here ordinates are taken not necessarily at equal intervals.
3. The same ordinates are now drawn isometrically on the isometric square.

4. The length of each intercepting ordinate is transferred from the auxiliary view to the isometric square until the whole circle is formed.

5. A French curve or an adjustable curve is needed to join all the points smoothly.

It is important to have a few ordinates accurately plotted than too many ordinates inaccurately plotted.

This method can also be applied to isometric curves and also non-isometric lines quite easily.

---

**Ordinate Method for Irregular Curves.**

The ordinate method is most suitable for the purpose. Number of ordinates taken will depend on curvature. Far apart ordinates on large curvature while closer ordinates on small curvature. Hence they need not be spaced at equal intervals apart.

**STEPS:**

1. An auxiliary view is drawn on the outline of the profile and a number of ordinates taken.

2. An isometric rectangle is drawn.

3. Offset measurement of the ordinates are plotted in the rectangle.
4. A French curve is used to join the outline and then the thickness is projected.

5. The final curve is then joined.

(c) Diagonal Method

This is modified form of ordinate method for circles or semicircles but will be inaccurate for curves rounded corners. Its modification being that only an ordinate is needed and hence reduces a great of construction and time.

STEPS:

1. An Isometric square of side equal to the circle diameter is drawn as before and positioned as required.

2. Another similar square is drawn with a circle Inscribed but as an auxiliary view.

3. The centre lines are joined and the diagonals too in both the squares. Four points are thus obtained on the ellipse only.

4. Where the diagonal intersect the circle in the auxiliary view an ordinate is taken.
5. By offset measurement the ordinate position is transferred to the isometric square and another four points are obtained on the diagonals. Hence the name 'diagonal method'.

6. A curve is then used to join the eight points.

**Isometric Drawing of Solid Cylinder.**

Very often several parallel circles have to be drawn. A cylinder is an example in which two are needed.

**STEPS.**

1. Construct the Isometric box according to the given diameter and length and Is positioned as required.

2. Construct the isometric circle to each end by any of the three methods. Darken the front (exposed) and lightly for the back circles.

3. Tangentially draw the 2. Construct the isometric circle to each end by any of the three methods. Darken the front (exposed) and lightly for the back circles.

**Isometric Drawing of Hollow Cylinders.**

Special attention is needed in the drawing of hollow cylinder as additional lines may have to be added.

**STEPS.**

1. Construct the required isometric box.

2. Construct in the concentric isometric circles (2 sets)
Isometric Drawing of Step Shafts.

Where a step shaft is to be drawn a reference plane will have to be taken and construction of a number of isometric boxes are built up.

Circles in oblique projection

- It is not always possible to position an object so that the circles or curves appear as the main or true face, unless specified otherwise.

- The circles or curves that have to be drawn on the adjacent side will also be drawn as ELLIPSES. The resulting ellipses can be drawn by using either the diagonal method or the ordinate method or by using an approximate construction similar to that describe for isometric projection.
(a) Compasses Method for Oblique Circles

The compasses method of obtaining four centres for constructing a circle in oblique is exactly the same as the American method of drawing isometric circle. However it is only limited to Cavalier Oblique Projection, ie. without correction of distortion.
Compasses method for the various position of the oblique circle required.

Steps of construction for oblique circles.

1. Draw an oblique square of side equal to circle diameter.
2. Join the longest diagonal.
3. As in isometric, at each raid-point of side shown, construct a line perpendicular to the side.
   These lines produced meet at C1 and C2
4. C3 and C4 are obtained where the diagonal meet the intersecting lines for C1 and C2.
(b) Ordinate Method.

This method should always be used where accuracy is concerned. The method of taking offset measurements is similar to that of isometric drawing.

Correction of Distortion.

In Cavalier Method, the distortion can be seen clearly and in order to avoid this effect, two other methods are introduced to correct this defect.

Other means of avoiding distortion are:

b) Curves and circular are drawn to the true shape on the reference plane.

Avoid placing longitudinal axis in the direction of the oblique axis but along the reference plane.
Examples of Isometric Projection

1. Two views of a cast iron bracket are shown. Make a full size isometric drawing of the bracket in the direction of the arrow shown.

2. Two views of a Vee-block are given. Draw an isometric view of the block, making the corner A nearest to you.

3. Make an isometric drawing of the rivet shown below. Make point n the lowest point on the isometric drawing.
Examples of Isometric Projection

4. Make an isometric drawing of the following views in the direction of arrow E.

5. Two views of a dovetail stop are shown below. Draw an isometric view of the block with the corner Y at the lowest part of the view.
Examples of Isometric Projection

6. Two views of a simple bearing are shown. Make an isometric drawing of the bearing in the direction of the arrow shown.

7. Two views of a bearing are shown. Make an isometric drawing of the bearing. Corner A should be the lowest point of the drawing.
Examples of Oblique Projection

Draw the oblique projections of the following views:

1.

2.
Examples of Oblique Projection

3.

![Oblique Projection Example 3](image)

4.

![Oblique Projection Example 4](image)
Examples of Oblique Projection