Engineering Graphics

1st Semester : Common to all Branches

June : 2016 (CBCS)

Note : **Max. marks : 60**

(i) Attempt any five questions.

(ii) All questions carry equal marks.

Q.1 **(a)** Draw the projections of following points on a common reference line keeping the distance between their projectors 30 mm apart.

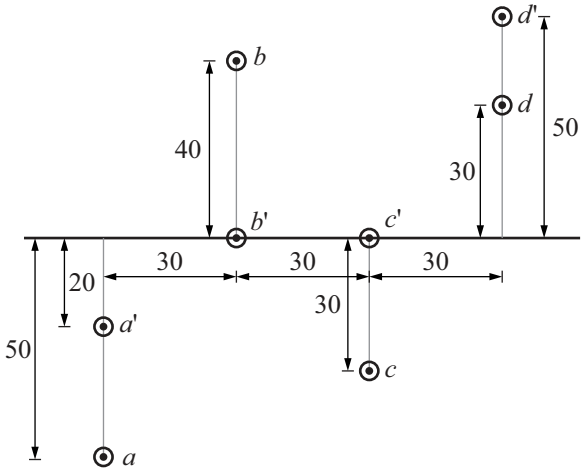
(i) Point A is 20 mm below the H.P. and 50 mm in front the V.P.

(ii) Point B is in the H.P. and 40 mm behind the V.P.

(iii) Point C is 30 mm in front of the V.P. and in the H.P.

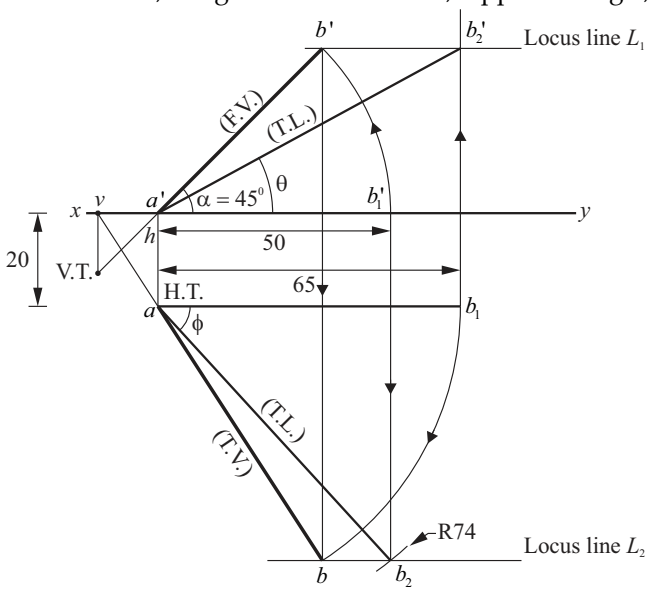
(iv) Point D is 50 mm above the H.P. and 30 mm behind the V.P.

Sol.



Q.1 **(b)** The front and top views of a straight line PQ measures 50 mm and 65 mm, respectively. The point P is on the H.P. and 20 mm in front of the V.P. The front view of the line is inclined at 45^0 to the reference line. Determine the true length of PQ and its true inclinations with the reference planes. Also, locate the trace.

Ans. **Given :** Length of F.V. = 50 mm, Length of T.V. = 65 mm, Apparent angle, $\alpha = 45^0$ (with H.P.)



Steps :

(i) Locate point a' on xy line in front view and point a 20 mm below xy line in top view of end A of line AB.

(ii) Draw $a'b_1' = 50$ mm assuming line AB parallel to H.P.

(iii) Draw line $ab_1 = 65$ mm long and parallel to xy line.

(iv) Through point a' rotate point $b_1' = 45^0$, with xy line to get point b'. Join $a'b'$.
$a'b'$ is the required F.V.

(v) At point b' draw locus line L_1 parallel to xy line.

(vi) Project the point b_1 upward upto b_2' on locus line L_1 and join $a'b_2'$. Now

$a'b_2'$ = True length of line AB

= 74 mm **Ans.**

(vii) Project b_1' downward. With center a and radius = 74 mm cut the projector line through b_1' at b_2 join ab_2. Draw a line L_2 parallel to xy line at b_2.

(viii) With center 'a' rotate b_1 up to point b on L_2 line, join ab. Line ab is top view of line AB.

(ix) Measuring the inclination of $a'b_2'$ and ab_2 with xy line, we get

$\theta = 28^0$ (with H.P.) **Ans.**

$\phi = 48^0$ (with V.P.) **Ans.**

(x) Extend the line through point 'a' on xy line as 'v' and through a' as V.T.

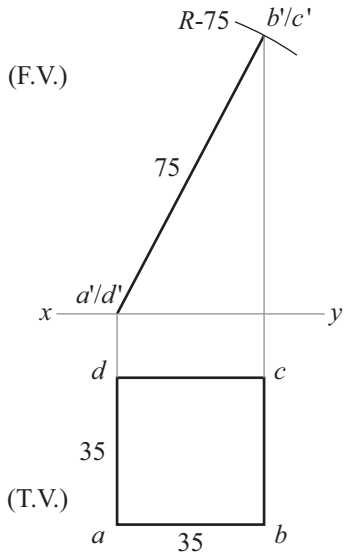
Q.2 **(a)** A rectangular plane of edges 35 mm and 70 mm is resting on an edge in the H.P. The surface is inclined to the H.P. such that the top view appears as a square. Draw its projections when the edge resting on the H.P. is perpendicular to the V.P.

Sol. **Steps :**

(i) As top view appears as a square, so draw a square of side 35 mm in top view. (One of the side should be perpendicular to V.P.)

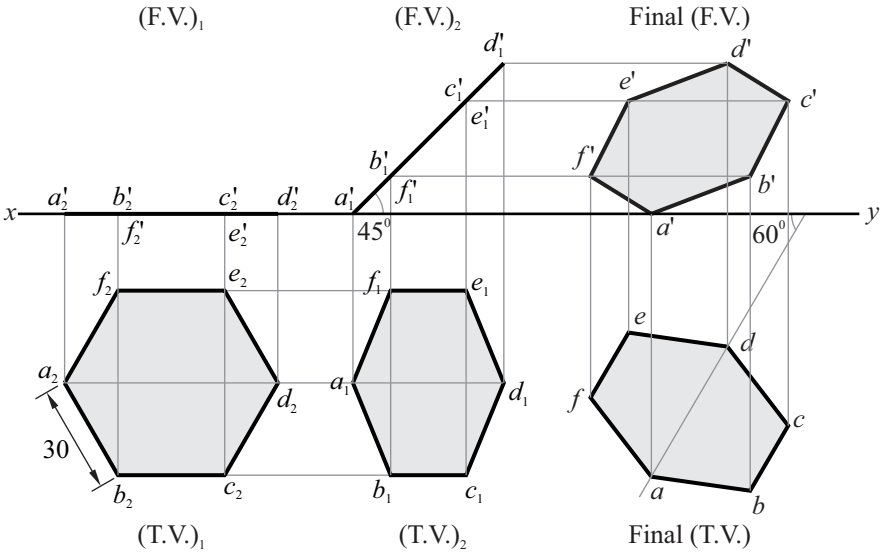
(ii) Project all the point in xy line.

(iii) As one edge is in the H.P. so locate point a' in xy and draw an of radius 75 mm to cut the projector line through band c at point b' or c'.
This is required F.V.



Q.2 **(b)** A hexagonal plane of side 30 mm has a corner on the ground. Its surface is inclined at 45^0 to the H.P. and the top view of the diagonal through the comer which is in the H.P. makes an angle of 60^0 with the V.P. Draw / projections.

Sol.



Steps :

(i) Initially assume hexagonal plane is resting on H.P. such that its nearest edge is parallel to V.P. Draw its

$(T.V.)_1$ - As a regular hexagon of 30 mm side.

$(F.V.)_1$ - As a line $a_2'd_2'$.

(ii) Inclined $(F.V.)_1$ at 45^0 with xy line keeping all the points at same position. This is $(F.V.)_2$.

(iii) With the help of $(F.V.)_2$ and $(T.V.)_1$, draw $(T.V.)_2$.

(iv) Inclined the diagonal a_1d_1 of $(T.V.)_2$ 60^0 with xy line keeping all the points in same position. This is the final T.V.

(v) With the help of final top view and $(F.V.)_2$, draw final front view. Now

Hexagon $a'b'c'd'e'f'$ - Final front view

Hexagon $abcdef$ - Final top view

Q.3 **(a)** A pentagonal prism of base side 30 mm and axis 60 mm has one of its rectangular faces on the H.P. and the axis inclined at 60^0 to the V.P. Draw its projections.

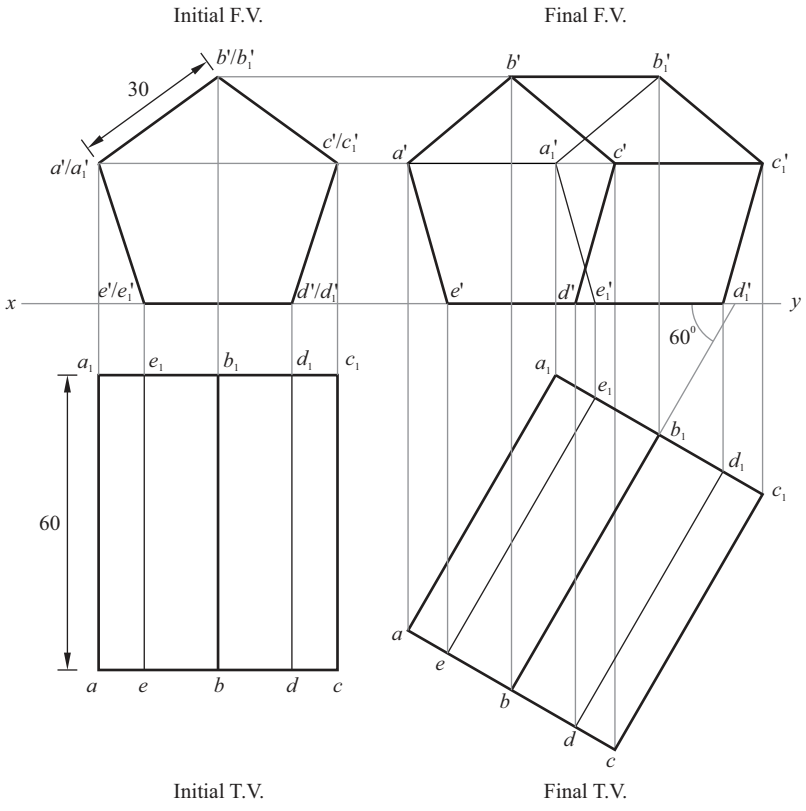
Sol. **Steps :**

(i) Draw pentagon of side 30 mm in initial F.V. (Such that one of the rectangular faces lies on xy.)

(ii) Project all the point in initial T.V. of axis length 60 mm.

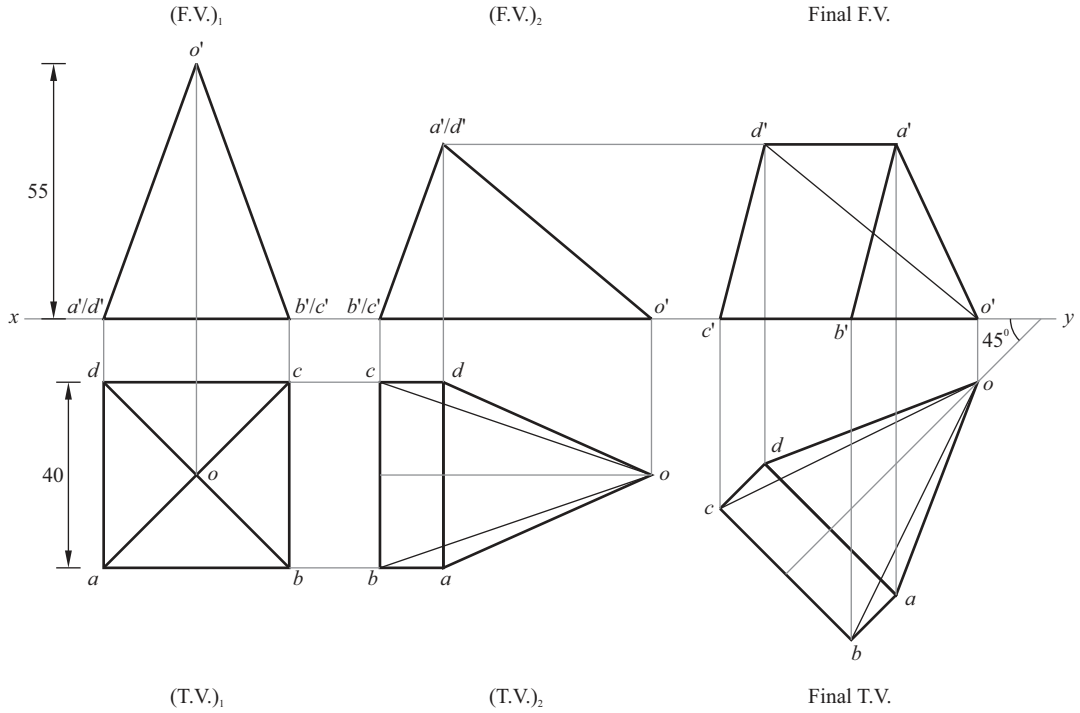
(iii) Inclined the axis of initial T.V. to 60^0 with xy (or V.P.) This is final T.V.

(iv) Project all the point above xy line with the help of final T.V. and initial F.V. draw final F.V.



Q.3 **(b)** A square pyramid of base side 40 mm and axis 55 mm is resting on one of its triangular faces on the H.P. A vertical plane containing the axis is inclined at 45^0 to the V.P. Draw its projections.

Sol.



Steps :

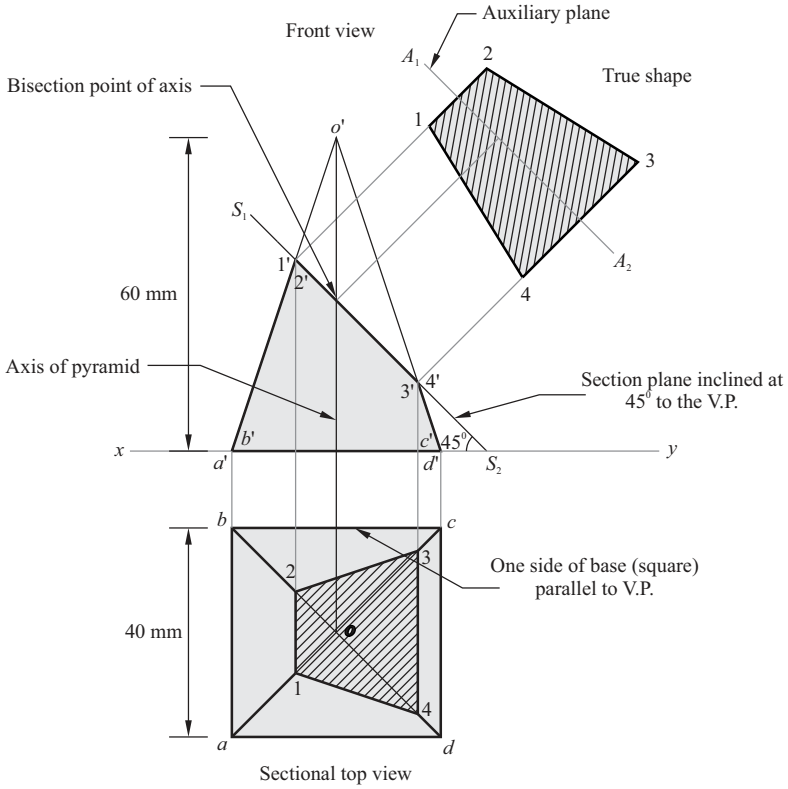
(i) Initial draw square pyramid as $(T.V.)_1$ Such that one side is parallel to xy , project is Front view as $(F.V.)_1$.

(ii) Draw $(F.V.)_2$ Such that one of the triangular face say $o'b'c'$ lies on H.P. project its Top view with the help of $(T.V.)_1$ and $(F.V.)_2$ as $(T.V.)_2$.

(iii) Inclined the axis of pyramid 45^0 to xy. This Final T.V. with the help of final T.V. and $(F.V.)_2$ draw final F.V.

Q.4 **(a)** A square pyramid of base side 40 mm and axis 60 mm is resting on its base on the H.P. with a side of base parallel to the V.P. Draw its sectional views and true shape of the section, if it is cut by a section plane perpendicular to the V.P. bisecting the axis and is inclined at 45^0 to the H.P.

Sol.



Steps of construction :

1. Square pyramid is resting on the H.P. on its base, therefore its cross-section is visible in the top view. Hence, top view is drawn first.

   Top view : Square of side 40 mm with on side parallel to the V.P.

2. Front view is drawn with the help of all the points from top view projected vertically upwards.

   Front view : Square pyramid having base equal to $a'd'$ and length of axis 60 mm long.

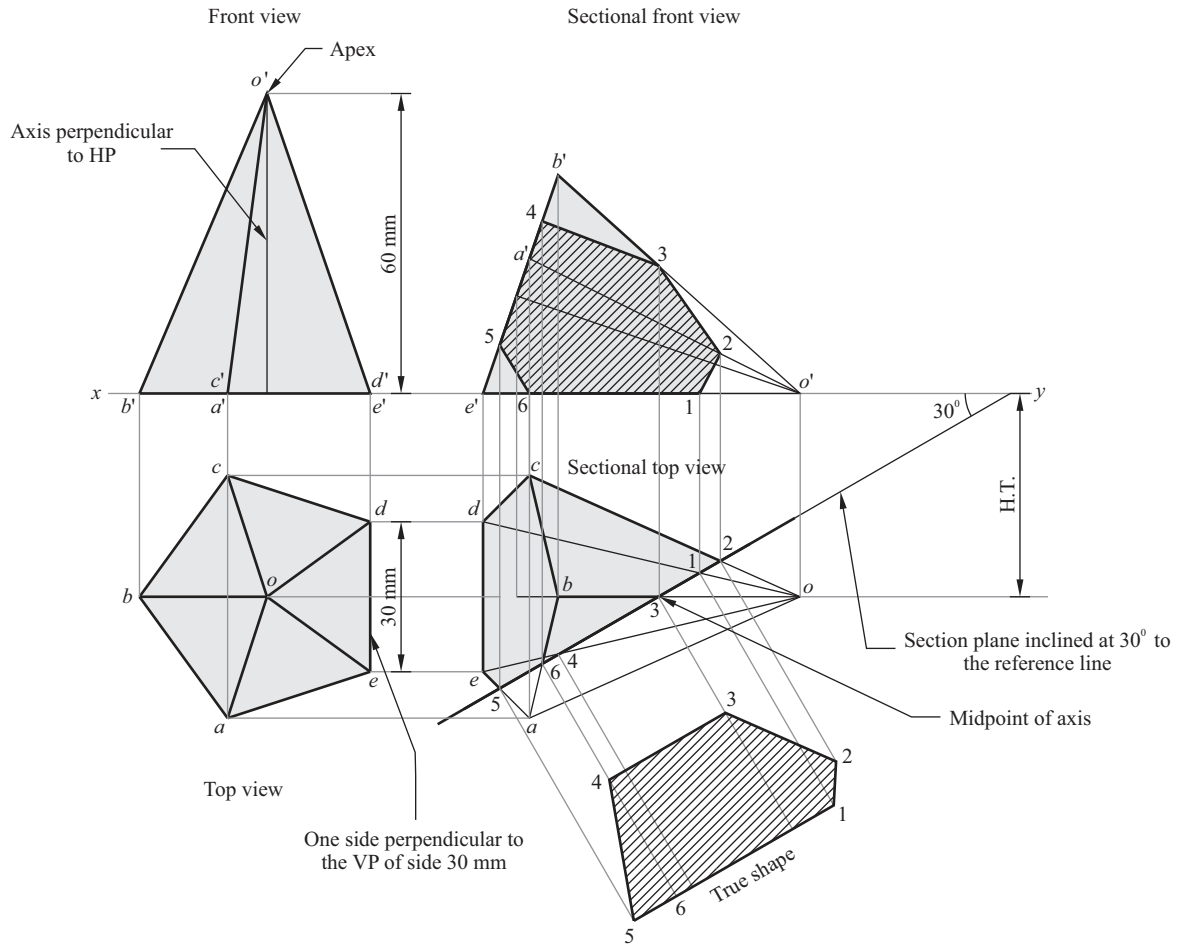
3. Section plane S_1S_2 is drawn from the bisection point (midpoint) of the axis at an angle of 45^0 with the H.P., thus generating points $1',2',3',4'$ in the front view.

4. Sectional top view is drawn with the help of all the points from $(1'$ to $4')$ front view projected downwards, thus generating points 1 to 4 in the top view.

5. True shape is drawn with the help of all the points from $1'$ to $4'$ and 1 to 4 from sectional tope view.

Q.4 **(b)** A pentagonal pyramid of base side 30 mm and axis 60 mm is resting on a triangular face on the H.P. with its axis parallel to the V.P. It is cut by a plane whose H.T. is inclined at 30^0 to the reference line and bisects the axis such that the apex is removed. Draw its sectional front view and obtain true shape of the section.

Sol.

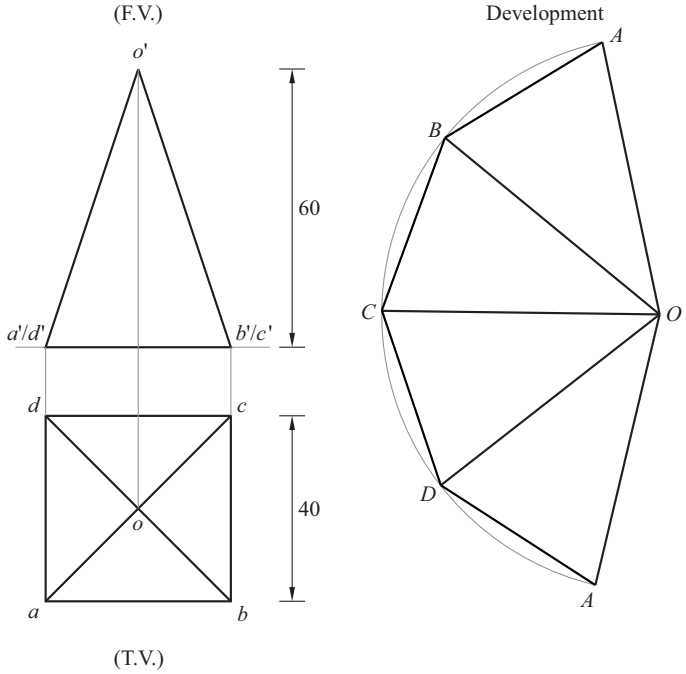


Steps of construction :

1. To draw the front view, the axis of the pyramid is made perpendicular to the xy line such that its base rests on H.P. Now, in this case, the pentagonal pyramid is resting on its base, therefore, its cross section is visible in the top view. Hence top view is drawn first.
   Top view : Pentagon of side 30 mm with one side perpendicular to VP.
2. Front view is drawn with the help of all the points from top view projects vertically upwards.
3. Section plane S_1S_2 is drawn bisecting the axis at an angle of 30^0 such that its H.T. meets the reference line, thus generating points from 1 to 6 in the sectional top view.
4. Sectional front view is drawn by projecting all the points from 1 to 6, thus generating points from 1′ to 6′ in the sectional front view.
5. True shape is drawn with the help of all the points from sectional top view and sectional front view.

Q.5 **(a)** Draw the development of lateral surface of a square pyramid of base side 40 mm and axis 60 mm resting on its base on the H.P., such that a side of the base is parallel to the V.P.

Sol.



Steps :

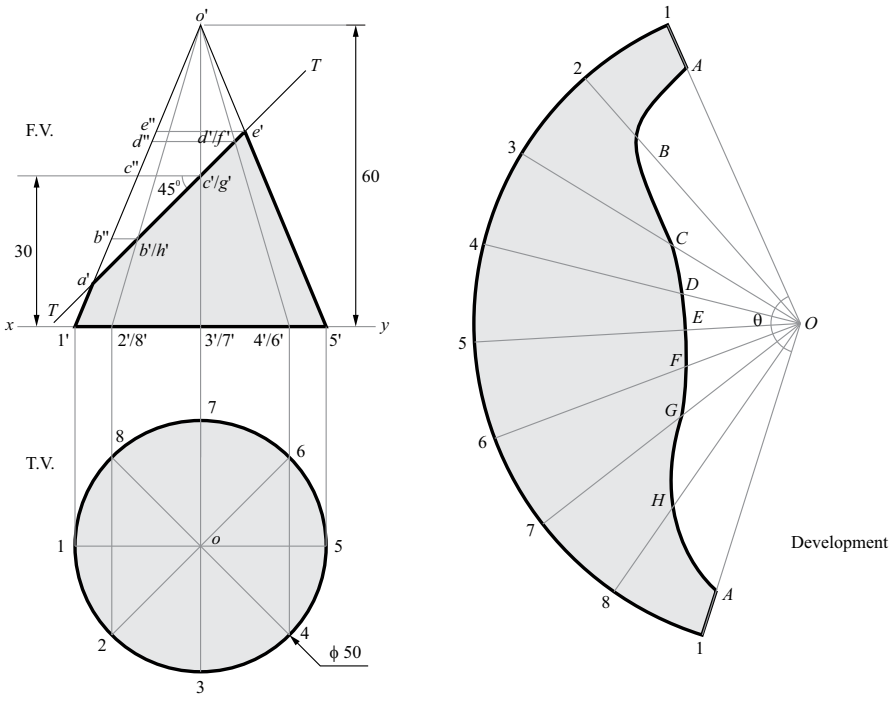
(i) Draw F.V. and T.V. of square pyramid when it is resting on H.P. with one of side having parallel to *xy* (or V.P.)

(ii) With radius *o'b'* and centre *O*, draw an arc of any length.

(iii) Taking one point *A* in this are cut an arc of length 40 mm to get point *B*, *C*, *D* and *A*. Joint all the point with dark line. This is the required Development.

Q.5 **(b)** A cone of base diameter 50 mm and axis 60 mm is resting on its base on the H.P. A section plane perpendicular to V.P. and inclined at 45^0 to H.P., bisects the axis of the cone. Draw the development of its lateral surface.

Ans.



Steps :

(i) Here generators $o'2', o'3', o'4', o'6', o'7'$ and $o'8'$ are not of the true length. Therefore, intersection points on these generators need to be projected on the generator $o'1'$ which is of true length. Point $b', c', d'.....e'$ are thus projected as $b'', c'', d''.....$ on generator $o'1'$.

(ii) Angle θ subtended by an arc at the centre is given as, $\theta = \frac{r}{s} \times 360^0$.

Where, $s =$ slant height of cone = 65 mm $= o'1'$, $r =$ radius of base = 25 mm,

$\therefore \quad \theta = \frac{25}{65} \times 360 = 138.5^0$

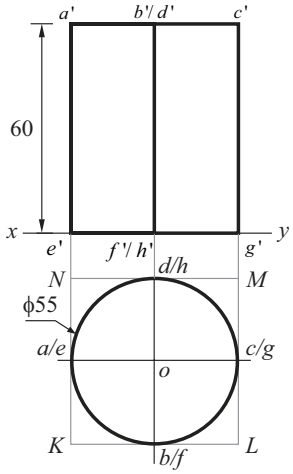
(iii) Mark point O and draw an arc of circle of radius = $o'1'$ with angle $\theta = 138.5^0$. Divide the arc $\overset{\frown}{1o1}$ into 8 equal parts.

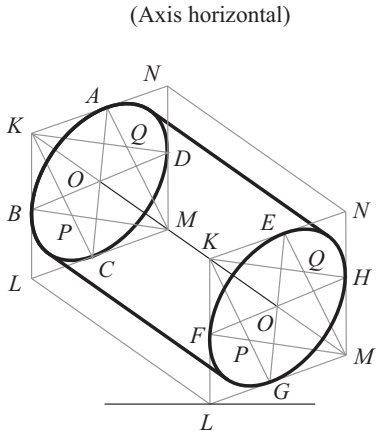
(iv) Mark point A on $O1$ such that $OA = o'a'$ and point B on $O2$ such that $OB = O'b''$. Similarly, mark point C, D, E, F, G and H on $O3, O4, O5, O6, O7$ and $O8$ respect.

(v) Draw smooth curve passing through points A, B, C, D….. etc.

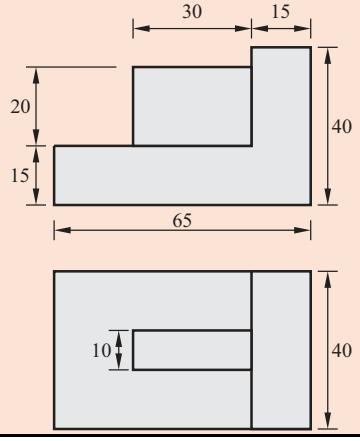
Q.6 (a) Draw the isometric view of a cylinder of base diameter 50 mm and axis 60 mm. The axis of the cylinder is perpendicular to the V.P.

Ans. **Steps :** Draw the ellipse as discussed earlier and the projection is drawn figure.

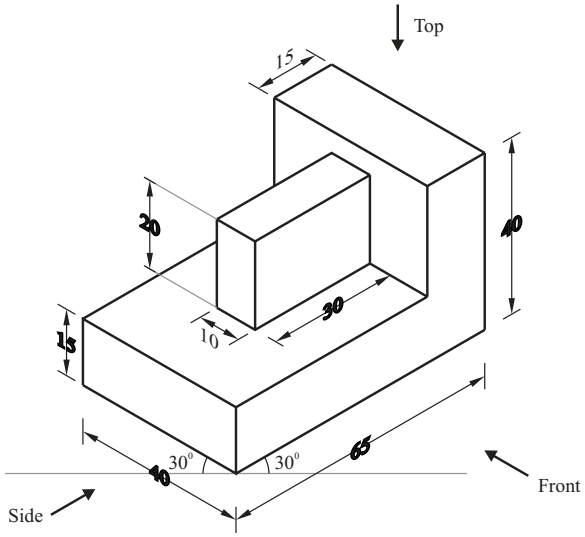




Q.6 (b) The front and top views of an angle plate are shown in figure 1. Draw its isometric view.



Sol.



Q.7 Write short notes on any three of the folic

(a) Advantages of CAD

(b) Co-ordinate systems used in CAD

(c) Four drawing commands

(d) Four edit commands

(e) Solid modelling

Ans. **(a) Advantages of CAD :** The CAD system should be used in modern Engineering practices because of the following reasons :

1. **CAD system are "User-friendly" :** Any person who has the basic knowledge of CAD system will be able to understand it very easily.
2. **Better quality designs :** The chances of mistakes is very less as compared to the traditional method of drawing; because the computer works very accurately, thus leading to a better quality design.
3. **Improved productivity :** CAD improves productivity of design and quality of the technical drawing as compared to the traditional methods of drawings.
4. **Reproducibility :** As the drawings are stored in a database, which is a collection of data of all types related to the drawing consuming very less space. Therefore, it can be reproduced very easily in future whenever required.
5. **Faster speed of work :** The drawing can be made with much faster speed than in traditional method, with the help of CAD systems.
6. **Easy modifications :** As a drawing can be saved many times, the changes in the drawing can be made very easily. Therefore repetitions can easily be made, which was not possible in traditional method of drawing.

(b) 1. Using Absolute Coordinate System :

Draw a line from point (5,5) to Point (10,10)

Command : LINE

From point : 5,5 (Select the point by mouse or enter the coordinates by keyboard).

To point : 10,10

To point : (Press Enter).

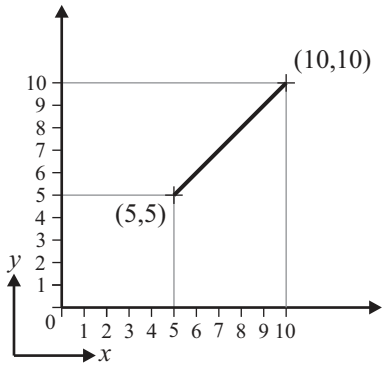


Fig. : To draw a line using Absolute Coordinate System

2. Using Relative Coordinate System :

Draw a line from point (2,2) to point 5 units in *x*-axis and 8 units in *y*-axis relative to first coordinate

Command : LINE

From point : 2,2

To point : @5,8

To point : (Press Enter)

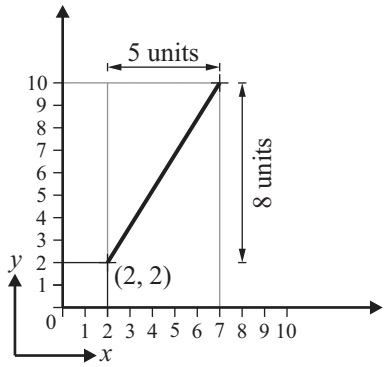


Fig. : To draw a line using Relative Coordinate System

3. Using Polar Coordinates :

Draw a line from point (1, 2) to a length of 6 units of 90 degree

Command : LINE

From point : 1,2

To point : @6<90

To point : (Press Enter)

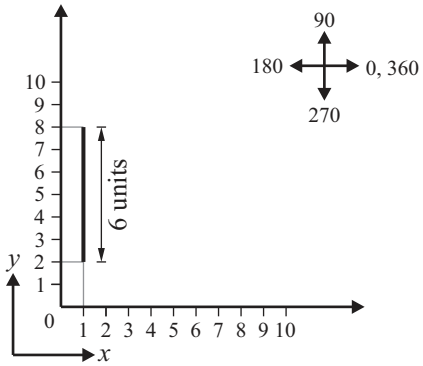
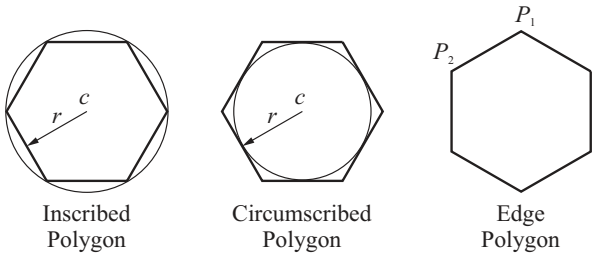


Fig. : To draw a line using Polar Coordinate System

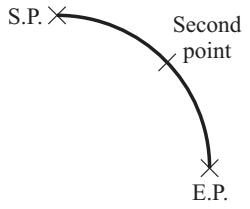
(c) Four drawing commands are :

1. **Line :** A line is specified by giving its two endpoints. Line command can be used to draw a single line or a series of lines with the end point of one being the start point of the next. When a series of such lines is created each line is treated as a separate entity.
   Syntax : LINE or L
2. **P line :** Poly lines are interesting drawing entities. Polyline can include both lines and arcs connected at endpoint. A polyline is a single entity with multiple segments. The polyline can be straight or curved, can be wide or tapered. Curve fittings and hatching can easily be performed on a polyline.
   Syntax : PLINE
3. **Polygon :** A polygon is also a polyline with equal length of sides. The regular polygon can either be inscribed in a circle or circumscribed about the circle. The polygon may also be constructed by specifying the length of one side and the number of sides of polygon called edges.
   Syntax : POLYGON

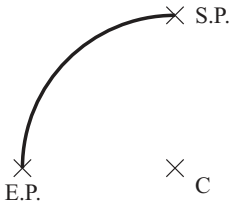


Inscribed Polygon | Circumscribed Polygon | Edge Polygon

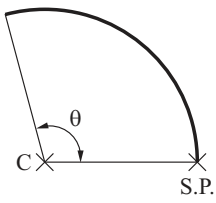
4. **Arc :** This command is used to draw an arc accurately.
   Syntax : ARC
   There are three parameters required for drawing an arc :
   (i) 3 point arc : The arc is drawing by specifying three point on the arc.
   (ii) Start center : This option needs start point and center point of an arc the third parameter may either be an endpoint, included angle, length of chord.
   (iii) Start, End : This option asks the user to enter the start and endpoints of an arc. The arc is completed by either specifying radius or included angle or center point.



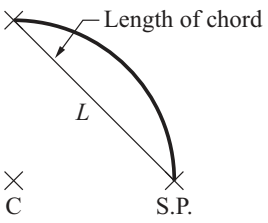
1. Start point, Second point, End point



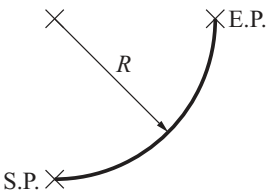
2. Center point, Start point, End point



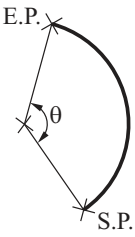
3. Center point, Start point, Included angle(θ)



4. Center point, Start point, Length of chord



5. Start point, End point, Radius



6. Start point, End point, Included angle (θ)

SP = Start Point, EP = End Point, C = Center of arc,
θ = Included angle of arc, R = Radius of arc, L = Length of chord of an arc.

(d) The fundamental commands to edit a drawing :

1. **Move :** Move command is used to move a selected object to another location about a base point.
   Syntax : MOVE
2. **Rotate :** Rotate command is used to rotate a selected object through a specified angle about a base point.
   Syntax : ROTATE
3. **Copy :** Copy command is used to create one or more copies of selected object at another location. The function of copy command is similar to the move command except that it preserves a copy of the object selected form the original location.
   Syntax : COPY
4. **Mirror :** Mirror command is used to create a mirror image of the selected objects about a specified line.
   Syntax : MIRROR

(e) Solid modeling : Solid modeling is the easiest type of 3D modeling among the wire-frame modeling, surface modeling and solid modeling. 3D objects can be created using the basic 3D shapes, viz, boxes, cones, cylinders, wedges, spheres, donuts (tori) etc.

2D solid modeling is a way of modeling in which a 2D object is converted into 3D object by sweeping it along a path, or by extruding it along any axis or by revolving it about an axis.

It is possible to convert from solid model to surface model; and from surface model to wireframe model, but, the reverse conversion from wireframe model or from surface model to solid model cannot be done.

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