KSU CET UNIT

FIRST YEAR NOTES

CET UNIT

4

Sections of solids

4.1. Introduction.

In orthographic projection, the invisible edges of an object are shown by dotted lines. When in a projection of an object, the invisible edges are more, all the dotted lines representing the invisible edges make the view more complicated and difficult to interpret. In such cases, the object is assumed to be cut by a plane called section plane or cutting plane. That portion of the object which is in between the observer and the cutting plane is assumed to be removed. The projections of the remaining portion of the object are called sectional views. In these views the sectioned portion of the object is shown by thin lines, uniformly spaced and generally inclined at 45^{o} with the horizontal or 45^{o} with the major dimension of the portion to be hatched.

The cutting plane is always perpendicular to one of the reference planes and may be parallel, inclined or perpendicular to the other reference plane. The general cutting planes are :-

1. Perpendicular to VP and parallel to HP. [Horizontal section plane]
2. Perpendicular to VP and inclined to HP.
3. Perpendicular to HP and parallel to VP.
4. Perpendicular to HP and inclined to VP.
5. Perpendicular to both HP and VP.
6. Perpendicular to profile plane and inclined to both HP and VP.

The projection of section plane on that reference plane to which it is perpendicular will be a line. This line is called trace of the section plane. When the section plane is perpendicular to HP, its horizontal trace is a line which can be shown in the plan of the object. When the section plane is perpendicular to VP, its vertical trace is a line which can

be shown in the elevation of the object. When the section plane is perpendicular to the profile plane, it can be shown by a line in the profile view. The trace of the cutting plane is shown by thin chain line with thick and dark end segments.

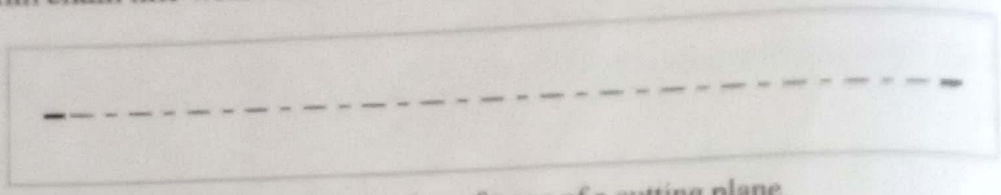

Fig. 4.1. Representation of trace of a cutting plane.

Trace of various cutting planes are shown in Fig. 4.2. They are:-

1. Perpendicular to VP and parallel to HP.
2. Perpendicular to VP and inclined to HP.
3. Perpendicular to HP and parallel to VP.
4. Perpendicular to HP and inclined to VP.
5. Perpendicular to both HP and VP.
6. Perpendicular to the profile plane and inclined to both HP and VP.

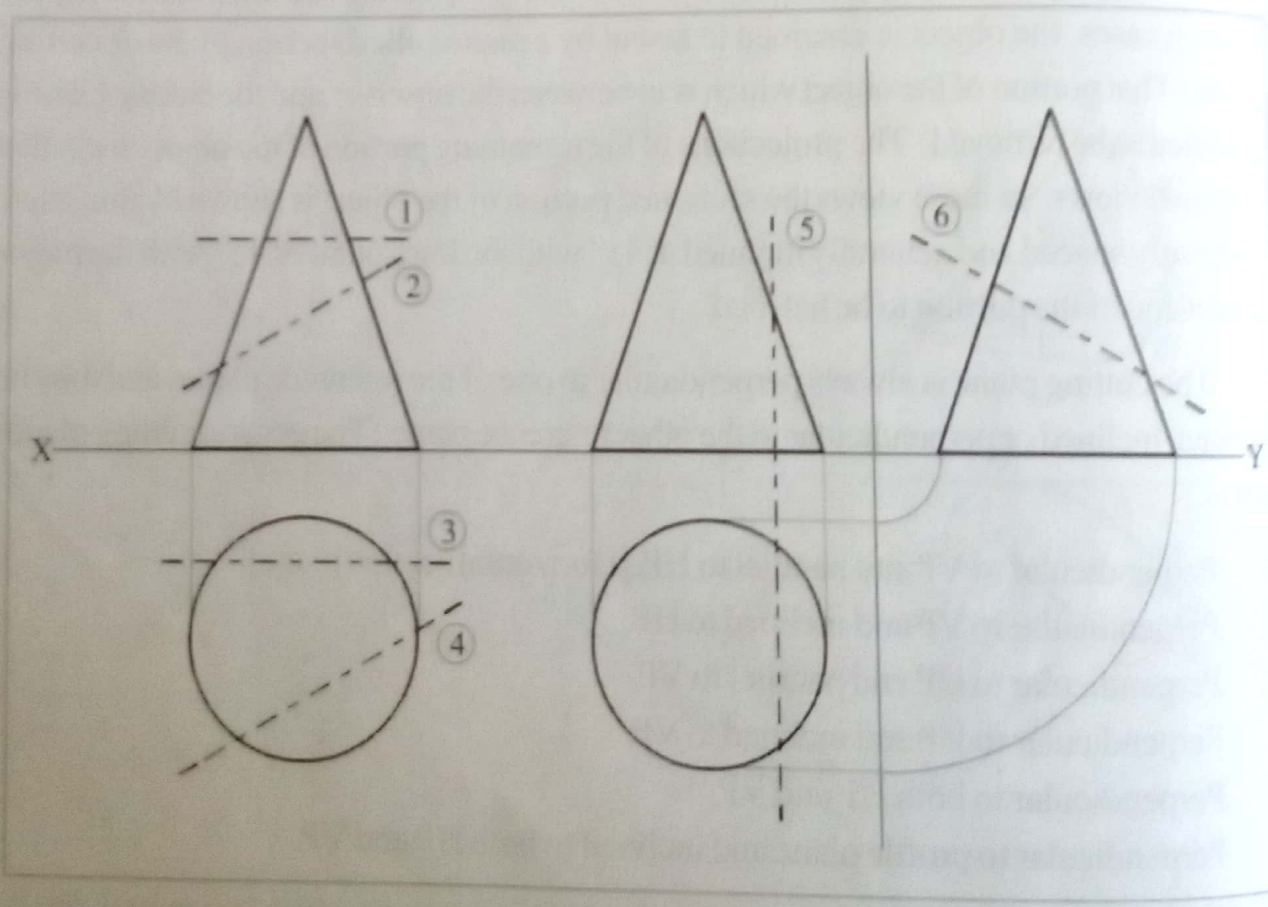

Fig. 4.2.

The true shape of the cut surface of the object can be seen on an auxiliary plane parallel to the section plane. When the cutting plane is perpendicular to VP, the auxiliary

plan of the cut surface on a plane parallel to the cutting plane will be the true shape of the cut surface. Similarly when the cutting plane is perpendicular to HP, the auxiliary elevation of the cut surface on a plane parallel to the cutting plane will be the true shape of the cut surface. $X_1 Y_1$ line should be drawn parallel to the trace of the cutting plane and at any convenient distance from the trace of the cutting plane. For drawing auxiliary plan of the cut surfaces draw lines perpendicular to $X_1 Y_1$ line from the elevation points marked on the vertical trace of the cutting plane. On these lines mark the points in the true shape of the cut surface by taking the distance of corresponding points in the plan from XY line. Similarly to draw the auxiliary elevation of the cut surface, from the various points marked in the horizontal trace of the cutting plane, draw lines perpendicular to $X_1 Y_1$ line. On these lines mark the points in the true shape of cut surface by taking the distance of corresponding points in the elevation from XY line. The true shape of the section should also be hatched with thin lines, uniformly spaced and generally inclined at 45° with horizontal or inclined at 45° with the major dimension in the true shape of cut surface.

Example 4.1.

A rectangular pyramid side of base 20mm x 25mm and axis height 35mm is kept with its base on HP. 25mm base edge is inclined at 20° with VP. It is cut by a section plane perpendicular to VP, inclined at 40° with HP and passing through the mid point of the axis. Draw the sectional plan, elevation and true shape of the cut surface.

Solution.

Draw the plan and elevation of the pyramid. Since the section plane is perpendicular to VP, it can be shown by a line in the elevation. Through the mid point of the axis draw the trace of cutting plane inclined at 40° with horizontal. On the trace, mark points 1′, 2′, 3′, and 4′ as shown in Fig. 4.3. Locate the points, 1,2,3 and 4 in the plan and join these points to get the plan of cut surface. Draw the $X_1 Y_1$ line, parallel to the trace of cutting plane and draw lines from the points 1′, 2′, 3′ and 4′, perpendicular to $X_1 Y_1$ line. The distance of point 1 in the true shape from $X_1 Y_1$ line is equal to the distance of point 1 in the plan from XY line. Locate the other points 2,3 and 4 in the true shape and join these points to get the true shape of the cut surface.

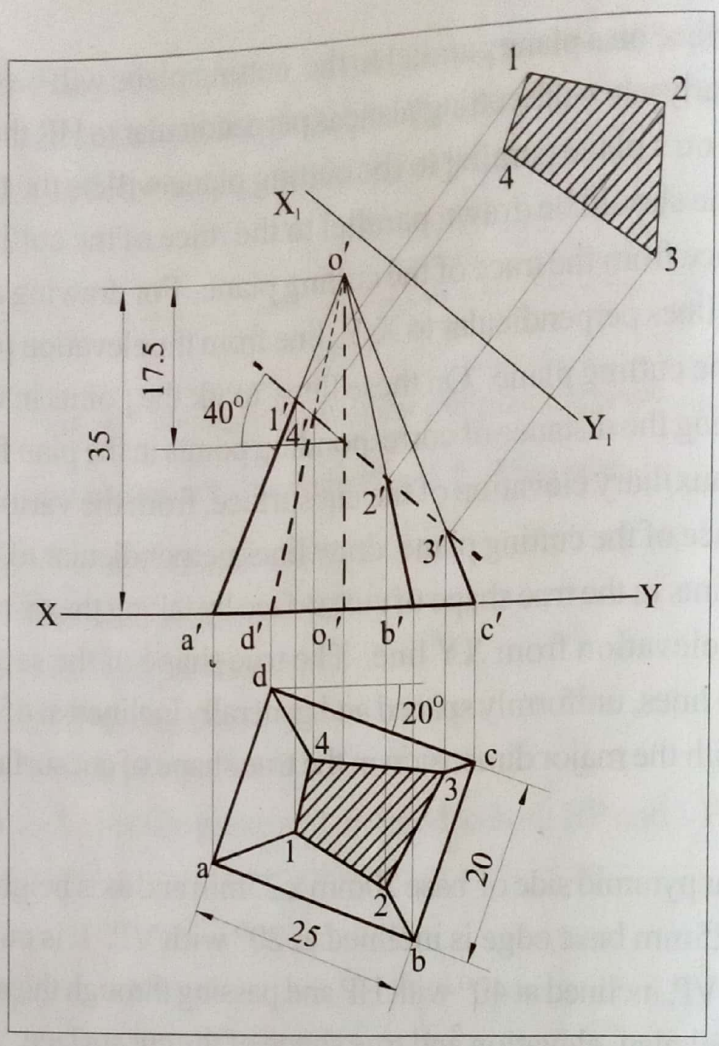

Fig. 4.3.

Problems for practice.

1. A hexagonal pyramid side of base 25mm and axis height 60mm is kept with its base on HP with one of the base edges inclined at 10° with VP. It is cut by a section plane perpendicular to VP, inclined at 45° with HP and passing through the midpoint of the axis. Draw its sectional elevation, plan and true shape of the cut surface.

2. A pentagonal pyramid side of base 25mm and axis height 50mm is kept with its base on HP with one of the base edges perpendicular to VP. It is cut by a section plane perpendicular to VP. Draw the sectional plan, elevation and true shape of the section when

i) the section plane passes through one of the base corners and is perpendicular to the triangular face opposite to this base corner.

ii) the section plane contains one of the base edges and is perpendicular to the slant edge opposite to the base edge.

3. A hexagonal pyramid side of base 20mm and height 50mm is kept with its base on HP. One of the base edges is kept parallel to VP. It is cut by a section plane perpendicular to VP which passes through one of the base corners and is perpendicular to the slant edge opposite to this base corner. Draw the sectional plan, elevation and true shape of the section.

University questions.

1. A pentagonal pyramid of base side 25mm and axis 55mm rests on its base on the HP with one of its base edges perpendicular to VP. It is cut by a plane perpendicular to the VP and inclined at 45° to the base. The cutting plane meets the axis at 25mm below the apex. Draw the front view, sectional top view and true shape of the section. [CUSAT June 2013].

2. A pentagonal pyramid of base edge 30mm and height 60mm is resting on its base with one of the base edges perpendicular to VP. A cutting plane inclined at 50° with HP, perpendicular to VP and passing through a corner cuts the pyramid. Draw the sectional front view, top view and side view of the bottom portion and the true shape of the section. [CUSAT May 2007].

Example 4.2.

A square pyramid side of base 25mm and axis height 35mm is kept with its base on HP with all the base edges equally inclined to VP. It is cut by a plane perpendicular to VP, inclined at 45° with HP and passing through the midpoint of the axis. Draw its sectional plan, elevation and true shape of cut surface.

Solution.

Draw the plan and elevation of the pyramid. Draw the trace of the section plane which is a line inclined at 45° with horizontal and passing through the midpoint of the axis. Mark points 1′, 2′, 3′ and 4′. Point 1′ is on o′ a′, 2′s on o′ b′, 3′ is on o′ c′ and 4′ is on o′d′ line. Locate point 1 on oa and point 3 on oc. To locate 2 on ob and 4 on oc, from the point (2′, 4′), draw a horizontal line to meet the line o′ a′ at p′.

From p′ draw a vertical line to meet the line oa at p. With o as centre, op radius draw an arc to cut the line ob at 2 and the line od at 4. Join these points 1,2,3 and 4 to get the plan of cut surface. Draw the true shape as shown in Fig. 4.4. The distances of points 1,2,3 and 4 in the true shape from X_1Y_1 line are the distances of points 1,2,3 and 4 in the plan from XY line respectively.

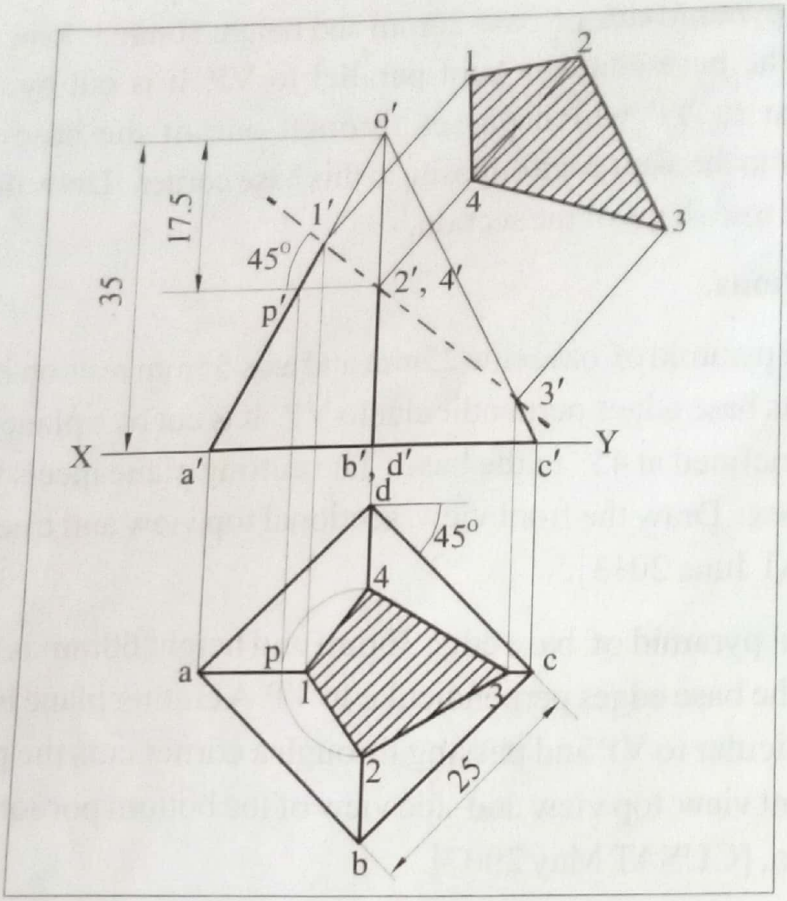

Fig. 4.4.

Problems for practice.

1. A hexagonal pyramid side of base 25mm and axis height 60mm is kept with its base on HP with two of the base edges perpendicular to VP. It is cut by a section plane perpendicular to VP, inclined at 45° with HP and passing through the midpoint of the axis. Draw its sectional plan, elevation and true shape of the cut surface.

2. A hexagonal pyramid side of base 20mm and height 50mm is kept with its base on HP. Two of the base edges are kept perpendicular to VP which contains one of the base edges and is perpendicular to the triangular face opposite to this base edge. Draw the sectional plan, elevation and true shape of the section.

University questions.

1. A pentagonal pyramid side of base 40mm and height 80mm is resting on the HP on its base with one of the base edges away from VP and parallel to VP. It is cut by an AIP inclined at 45° to the HP and bisecting the axis. Draw the elevation and sectional plan. [KU. June 2010].
2. A hexagonal pyramid of base side 25mm and axis 60mm rests on its base on the HP with two base edges perpendicular to the VP. It is cut by a plane perpendicular to

the VP and inclined at 30° to the HP meeting the axis at 25mm from the vertex. Draw the elevation, sectional plan and the true shape of the section. [CUSAT June 2008].

3. A right regular square pyramid, edge of base 35mm, rests on its base on HP, with its base edges equally inclined to VP. A section plane perpendicular to VP and inclined to the HP at 45°, cuts the pyramid bisecting its axis. Draw the front view, sectional top view and true shape of the section of the truncated pyramid. [CUSAT. June 2007].

Example 4.3.

A rectangular prism side of base 20mm x 25mm and axis height 35mm is kept with its base on HP with 25mm base edge inclined at 15° with VP. It is cut by a section plane perpendicular to VP, inclined at 60° with HP and passing through the top end of the axis. Draw the sectional plan, elevation and true shape of the section.

Solution.

Draw the plan and elevation of the prism. Draw the vertical trace of the cutting plane, passing through o′ and inclined at 60° with horizontal. Mark point 1′ on a′ b′, 2′ on

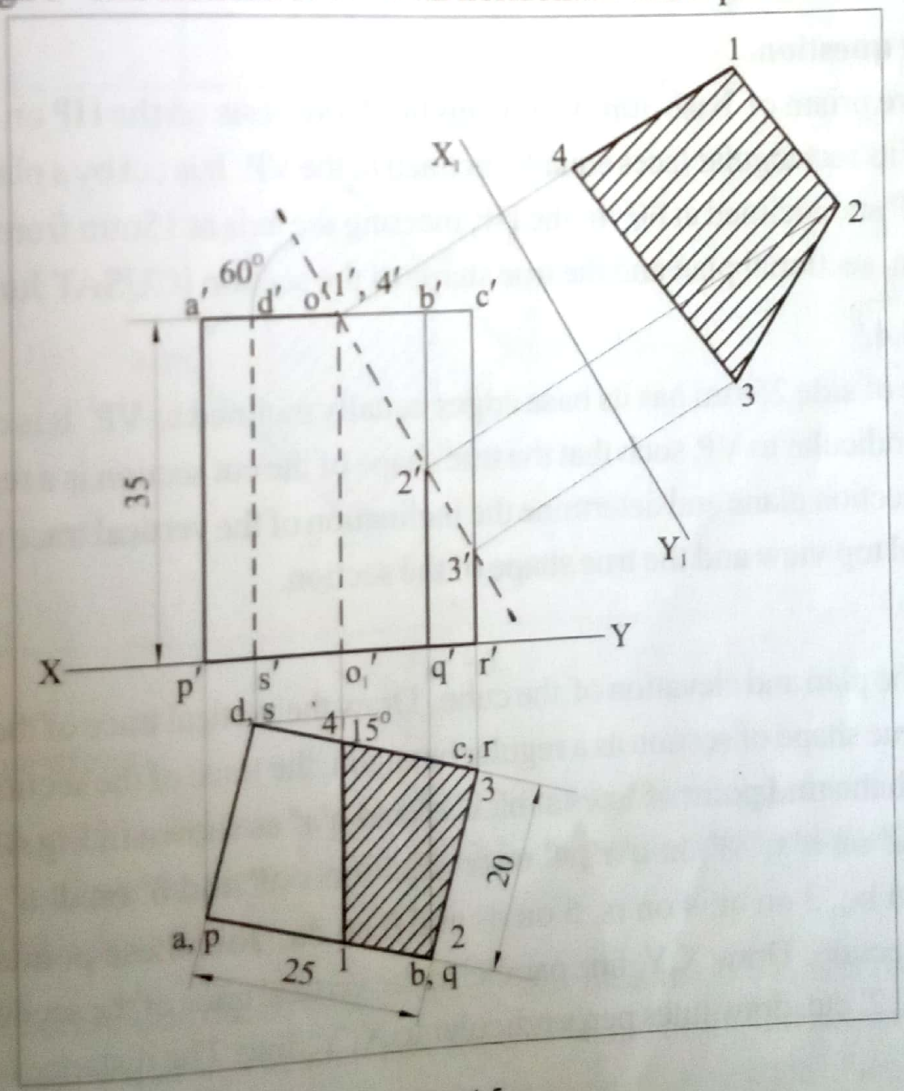

Fig. 4.5.

b′ c′, 3′ on c′ r′ and 4′ on c′ d′. Locate the points 1, 2, 3 and 4 in the plan. Point 1 on ab, 2 on bc, 3 on cr and 4 on cd. Join these points to get the plan of section as shown in Fig. 4.5. Draw X_1Y_1 line parallel to the trace of the cutting plane, at any convenient position. From these points 1′, 2′, 3′ and 4′ draw lines perpendicular to X_1Y_1 line. Mark points 1, 2, 3 and 4 in the true shape of the section such that the distance of 1 in the true shape from X_1Y_1 line is equal to the distance of point 1 in the plan from XY line. The distance of point 2 in the true shape from X_1Y_1 line is the distance of 2 in the plan from XY line. Like this locate points 3 and 4. Join these points as shown in Fig. 4.5.

Problem for practice.

A rectangular prism side of base 25mm x 30mm and axis height 50mm is kept with its base on H.P. The rectangular vertical face containing the 30mm base edge is inclined at its base on H.P. The rectangular vertical face containing the 30mm base edge is inclined at 20^o with VP. It is cut by a section plane perpendicular to VP, inclined at 40^o with HP and passing through the midpoint of the axis. Draw the sectional plan, elevation and true shape of the section.

University question.

A square prism of base 30mm and height 75mm rests on the HP on one of its ends with two of its rectangular faces equally inclined to the VP. It is cut by a plane perpendicular to the VP and inclined at 60^o to the HP, meeting the axis at 15mm from the top. Draw its elevation, sectional plan and the true shape of the section [CUSAT June 2012].

Example 4.4.

A cube of side 25mm has its base edges equally inclined to VP. It is cut by a section plane perpendicular to VP, such that the true shape of the cut section is a regular hexagon. Locate the section plane and determine the inclination of the vertical trace with HP. Draw the sectional top view and the true shape of the section.

Solution.

Draw the plan and elevation of the cube. Draw the vertical trace of the section plane. To get the true shape of section as a regular hexagon, the trace of the section plane should pass through the mid point of lines a′ b′, b′ q′ and q′ r′ as shown in Fig.4.6. Mark point 1′ on a′ b′, 2′ on b′ q′, 3′ on q′ r′, 4′ on r′ s′, 5′ on s′ d′ and 6′ on d′ a′. Locate point 1 on ab, 2 on bq, 3 on qr, 4 on rs, 5 on ds and 6 on da. Join these points to get the top view of the section. Draw X_1Y_1 line parallel to the vertical trace of the section plane. From the points 1′, 2′ etc. draw lines perpendicular to X_1Y_1 line. The distance of point 1 in the

true shape from X_1Y_1 line is the distance of point 1 in the plan from XY line. Like this locate the other points 2,3,4 etc. in the true shape and join these points to get the regular hexagon.

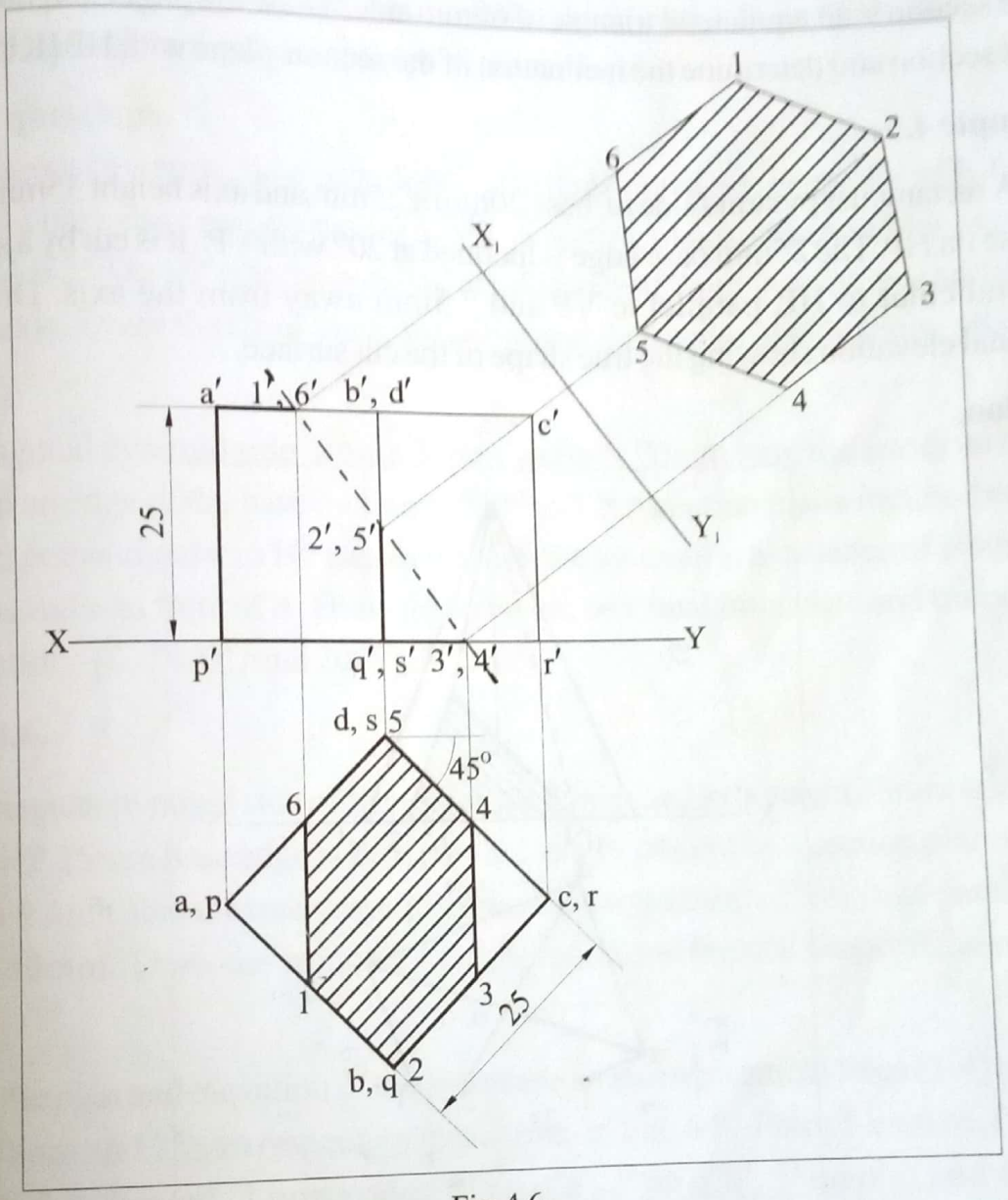

Fig. 4.6.

University questions

1. A cube of side 50mm is cut by a plane such that the true shape of section is a regular hexagon. Indicate the section plane and draw the sectional plan and true shape of the section. [KU. June 2011].
2. A cube of 60mm side has its base edges equally inclined to VP. It is cut by a section plane perpendicular to VP, such that the true shape of the cut section is a regular hexagon. Locate the plane and determine the angle of inclination of the vertical trace

with the reference line XY. Draw the sectional top view. [CUSAT June 2013]

3. A cube of side 60mm is resting on one of its faces on HP such that its vertical faces are equally inclined to both VP and HP cuts the solid in such a way that the true shape of the section is an equilateral triangle of 60mm side. Draw the projections and true shape of the section and determine the inclination of the section plane with HP [KU June 2013].

Example 4.5.

A rectangular pyramid side of base 20mm x 25mm and axis height 35mm is kept with its base on HP. The 25mm base edge is inclined at 20° with VP. It is cut by a section plane perpendicular to HP, parallel to VP and 7.5mm away from the axis. Draw its plan, sectional elevation showing the true shape of the cut surface.

Solution.

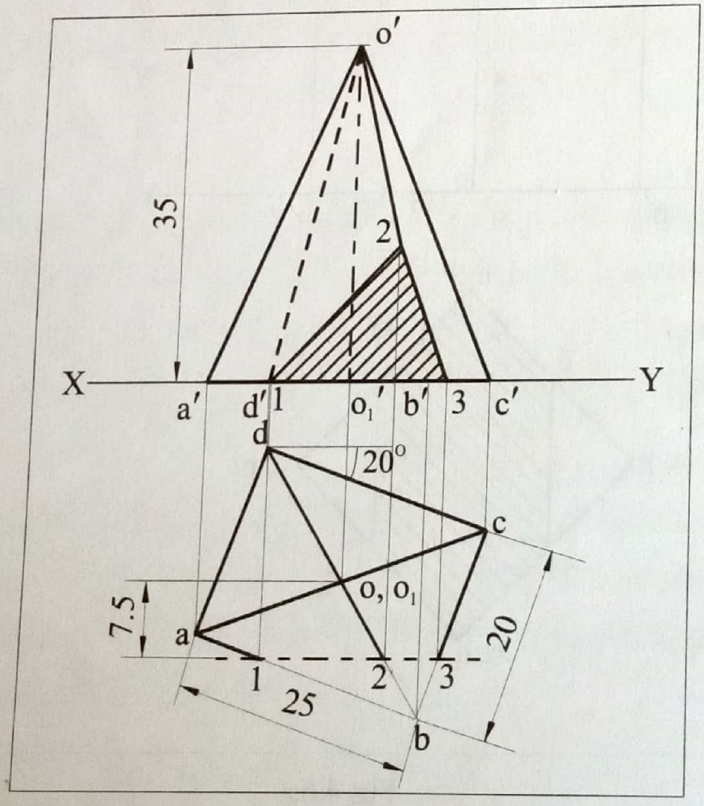

Fig. 4.7.

Draw the plan and elevation of the pyramid. Draw the horizontal trace of the cutting plane which is parallel to XY line and 7.5mm below the axis o o_1. Mark the point 1 on ab, 2 on ob and 3 on bc. Locate the elevation of these points 1′on a′b′, 2′ on o′ b′, and 3′ on b′c′. Join the points 1′, 2′ and 3′. Since the section plane is parallel to VP the section is parallel to VP and hence the elevation of section itself is the true shape of the section.

Problem for practice.

A hexagonal pyramid side of base 25mm and axis height 60mm is kept with its base on HP. One of the base edges is inclined at 20° with VP. It is cut by a section plane perpendicular to HP, parallel to VP and 10mm away from the axis. Draw the plan and sectional elevation showing the true shape of the section.

University questions.

1. A pentagonal pyramid, base edge 3cm and height 6cm stands vertically with base on HP and a base edge perpendicular to VP. A cutting plane perpendicular to HP and inclined at 25° to VP cuts the pyramid at a distance of 7mm from its axis and in front of the axis. Draw the front view, top view and the sectional side view. [KU May 2008].

2. A hexagonal pyramid side of base 30mm and axis 70mm long rests with its base on HP and an edge of the base inclined at 30° to VP. A section plane inclined at 45° to VP and perpendicular to HP passes through the pyramid at a distance of 10mm from the axis and is in front of it. Draw the top view, sectional front view and true shape of the section. [CUSAT June 2009].

Example 4.6.

A rectangular pyramid side of base 20mm x 25mm and axis height 35mm is kept with its base on HP 25mm base edge is kept parallel to VP. It is cut by a section plane perpendicular to VP such that the true shape of section is a trapezium of length of parallel sides 15mm and 10mm. Draw the sectional plan elevation and the true shape of the section.

Solution.

Draw the plan and elevation of the pyramid. Draw two vertical lines (1-4) and (2-3) of length 10mm and 15mm respectively as shown in Fig. 4.8. Point 1 is on oa, 2 is on ob, 3 is on oc and 4 is on od. Locate point 1′ on o′a′, 2′ on o′b′, 3′ on o′c′ and 4′ on o′d′ as shown in Fig 4.8. Join the points (1′, 4′) and (2′, 3′) to get the vertical trace of the section plane. Join the points 1,2,3 and 4 to get the plan of section and draw the true shape of the section as shown in Fig. 4.8.

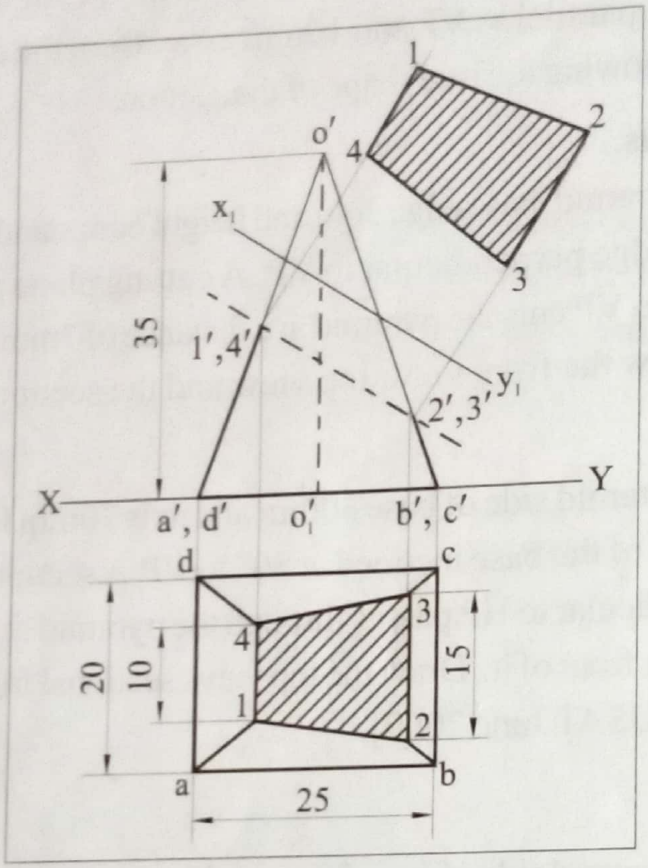

Fig. 4.8.

Problem for practice.

A square pyramid side of base 40 mm and axis height 50mm is kept with its base on HP with one of the base edges parallel to VP. It is cut by a section plane perpendicular to VP and inclined to HP such that the true shape of section is a trapezium with lengths of parallel sides 30mm and 15mm. Draw the elevation, sectional plan and true shape of the section.

University question.

A triangular pyramid with a base side of 50mm and height of axis 80mm is standing on its end on the ground with a side of the end perpendicular to the VP. It is cut by an AIP in such a way that the true shape of the section is a trapezium with parallel sides of 40mm and 12mm. Draw the projections and an auxiliary view showing the true shape of the section. Find the angle made by the cutting plane with the HP [KU June 2010].

Example 4.7.

A cylinder of diameter 30mm and height 35mm is resting on its base on HP. It is cut by a plane inclined at 60° to HP and passing through the top end of the axis. Draw the sectional plan, elevation and true shape of the section.

Solution.

Draw the plan and elevation of the cylinder. Draw the vertical trace of the cutting plane passing through o' and inclined at 60° with horizontal. Mark point 1' at c', 2' on d' s',

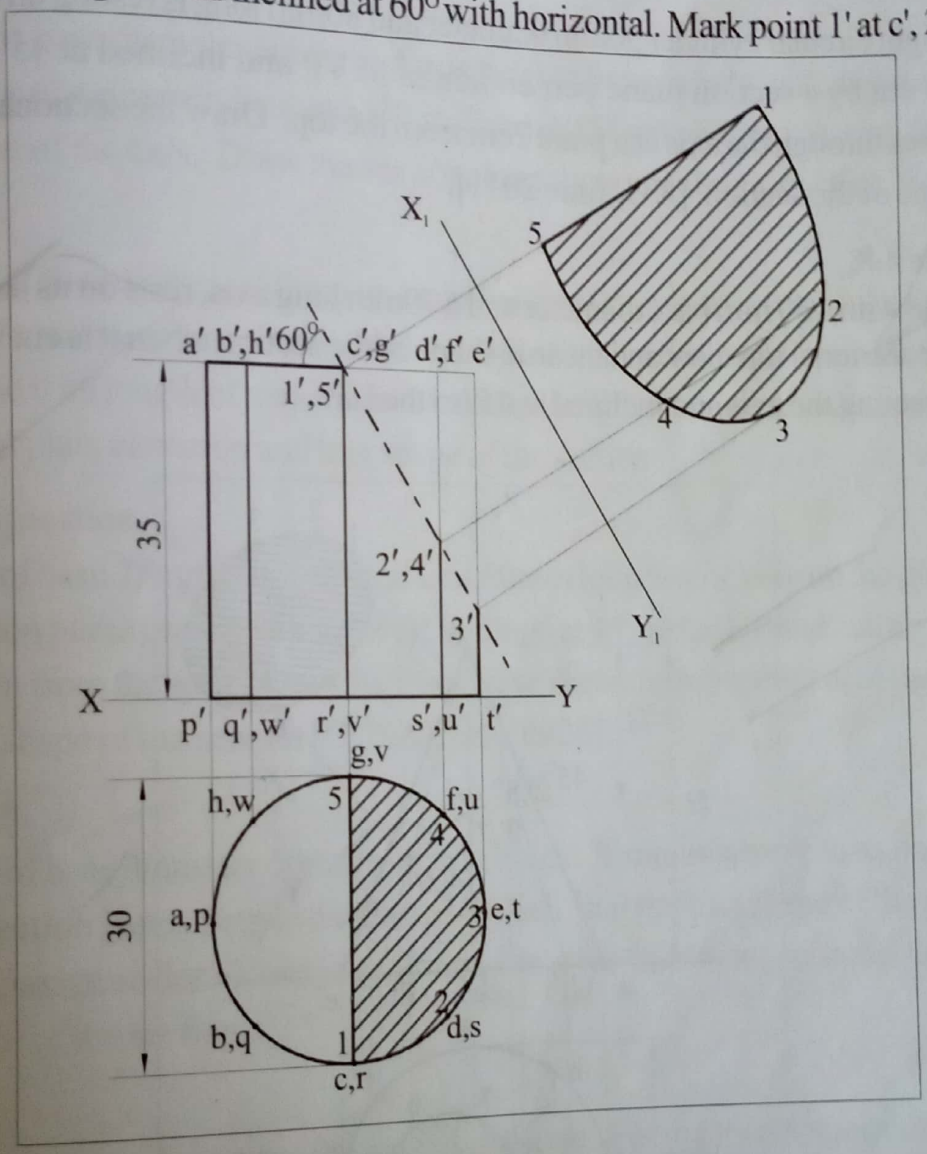

Fig. 4. 9.

3' on e 't', 4' on f 'u' and 5' at g'. Locate point 1 at c, 2 on ds, 3 on et, 4 on fu and 5 at g. Join the points 1 and 5. Draw the true shape of the section as shown in Fig. 4.9.

University questions.

1. A cylinder is resting on its base on HP. It is cut by a plane inclined at 45° to HP and cutting the axis at a point 16mm from the top end. If the diameter of the cylinder is

44mm and height is 60mm, draw the projections of the sectioned cylinder and the true shape of section [CUSAT June 2013].

2. A right circular cylinder, diameter of base 50mm and 70mm long rests on its base on HP. A section plane perpendicular to VP and inclined to HP at an angle of 45° with the cylinder, meeting its axis at 52mm from its base. Draw its sectional top view, sectional left side view and true shape of the section. [CUSAT June 2009].

3. A right circular cylinder 50mm diameter and 80mm long is resting on its base on HP. It is cut by a section plane perpendicular to VP and inclined at 45° with HP and passes through the axis at a point 2cm from the top. Draw the sectional plan and true shape of the section. [KU. June 2011].

Example 4.8.

A cone with a 60 mm base diameter and a 70mm long axis, rests on its base on the HP. Draw the sectional top view and the true shape of the section when it is cut by an inclined plane bisecting the axis and inclined at 45° to the HP.

Solution.

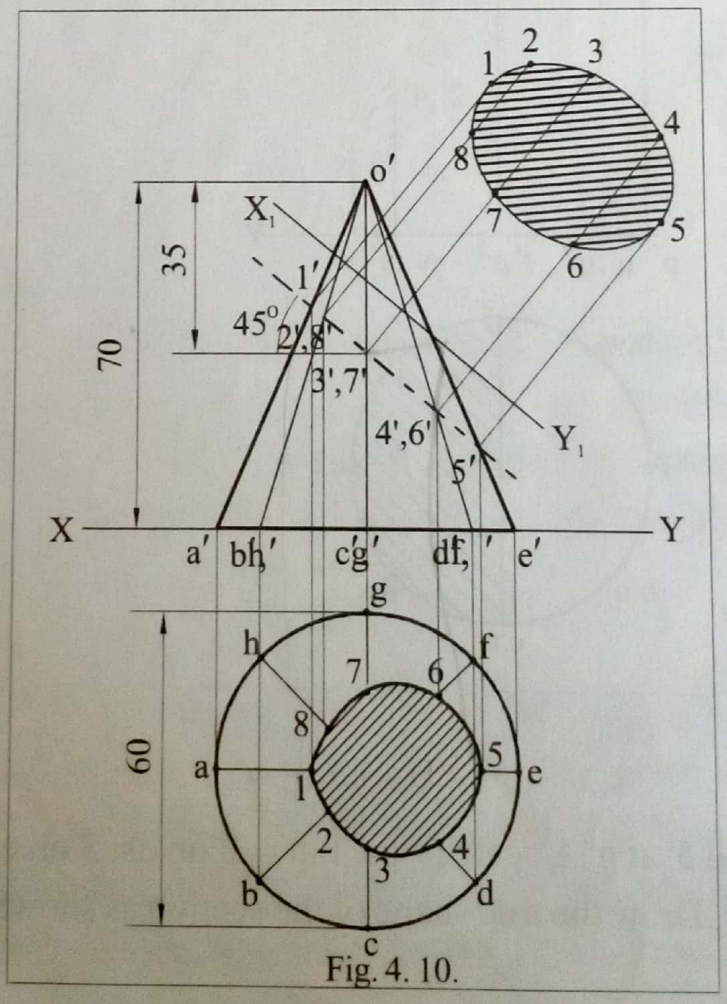

Fig. 4. 10.

Draw the plan and elevation of the cone.Draw the vertical trace of the cutting plane, which is inclined at 45° with XY line and passing through the mid point of the axis, Mark

point 1′ on o′ a′, 2′ on o′ b′, 3′ on o′ c′, 4′ on o′ d, 5′ on o′ e′, 6′ on o′ f′, 7′on o′ g′ and 8′ on o′ h′. Locate point 1 on oa, 2′ on ob, 3 on oc, 4 on od, 5 on oe, 6 on of, 7 on og and 8 on oh. Join these points to get the plan of section. Draw the true shape of the section as shown in Fig. 4.10. Since the section plane cuts both the end generators of the cone, the true shape of section is an ellipse. The length of major axis of this ellipse is the length of vertical trace in between the end generators.

Problems for practice.

1. A cone of base diameter 50mm and axis height 60mm is kept with its base on HP. It is cut by a plane perpendicular to VP, inclined at 45° with HP and passing through the midpoint of the axis. Draw the sectional top view, elevation and true shape of the section.

2. A cone of base diameter 50mm and axis height 60mm is kept with its base on HP. It is cut by a section plane perpendicular to VP such that the true shape of the section is an ellipse with length of major axis 40mm and length of minor axis 20mm. Draw the sectional plan, elevation and true shape of the section.

University question.

A cone of base 75mm diameter and axis 80mm long has its base on the ground. It is cut by a section plane perpendicular to VP, inclined at 45° to the HP and cutting the axis at a point 35mm from the apex. Draw its front view, sectional top view, sectional side view and the true shape of the section [CUSAT June 2008].

Example 4.9.

A cone of base diameter 60mm and axis height 70mm is kept with its base on HP.It is cut by a section plane perpendicular toVP such that the true shape of the section is a parabola of maximum double ordinate 50mm. Draw the front view, sectional top view and the true shape of the section.

Solution.

Draw the plan and elevation of base of the cone. For the true shape of the section to be a parabola, the cutting plane should be parallel to one of the end generators. Draw a vertical line in the plan, of length equal to the required length of double ordinate of the of the parabola(50mm). Extend this line 4-5 to meet the base of cone at point 4′, 5′. From this point draw a line parallel to the end generator o′ e′ to meet the generator o′ a′ at 1′. Mark the point 2′ on o′ b′, 3′ on o′ c′, 6′ on o′ g′ and 7′ on o′ h′. Locate point 1 on oa, 2 on ob, 3 on oc, 6 on og and 7 on oh. Join these points by a smooth curve to get the top

view of the section. Draw the true shape of the section as shown in Fig. 4.11.

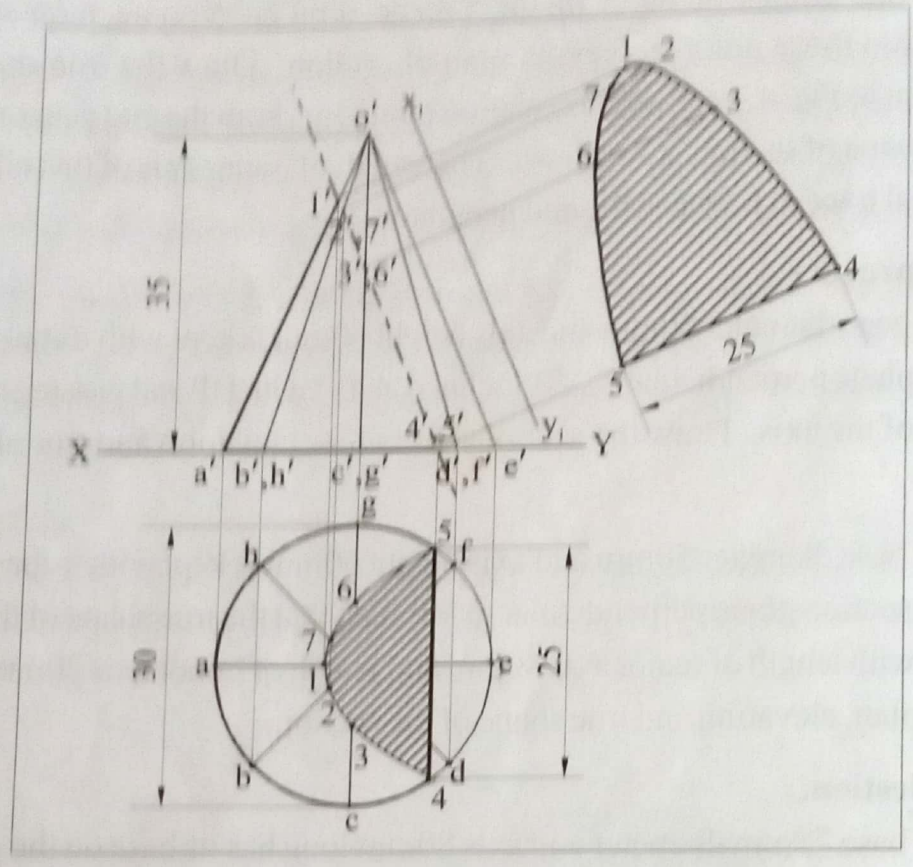

Fig. 4.11

Problems for practice.

1. A cone of base diameter 50mm and axis height 60mm is kept with its base on HP. It is cut by a plane perpendicular to VP and passing through a point on the axis 25mm below the apex such that the true shape of the section is a parabola. Draw the sectional plan and true shape of the section.

2. A cone of base diameter 60mm is kept with its base on HP. It is cut by a section plane perpendicular to VP such that the true shape of section is a parabola with length of base 50mm and height 60mm. Draw the sectional plan, elevation and true shape of the section. What is the height of the cone? What is the inclination of section plane with HP?

University questions.

1. A cone of base diameter 50mm and 60mm height is resting on its base on HP. It is cut by a section plane such that the true shape produced is a parabola of maximum double ordinate 40mm. Locate VT of the section plane and draw sectional top view

and true shape of the section. [KU June 2012].

2. A cone of base 50mm diameter and 60mm height is resting on its base on HP. It is cut by a section plane such that the true shape produced is a parabola of base 40mm. Draw the sectional top view, side view and the true shape obtained. [CUSAT June 2010].

Example 4.10.

A cone of base 30mm diameter and height 35mm is kept with its base on HP. It is cut by a plane perpendicular to VP such that the true shape of the section is a hyperbola with double ordinate 30mm and abscissa 25mm. Draw the sectional plan and true shape of the section.

Solution.

Draw the plan and elevation of the cone. For the true shape of the section to be a hyperbola, the vertical trace should cut the base and one of the end generators should

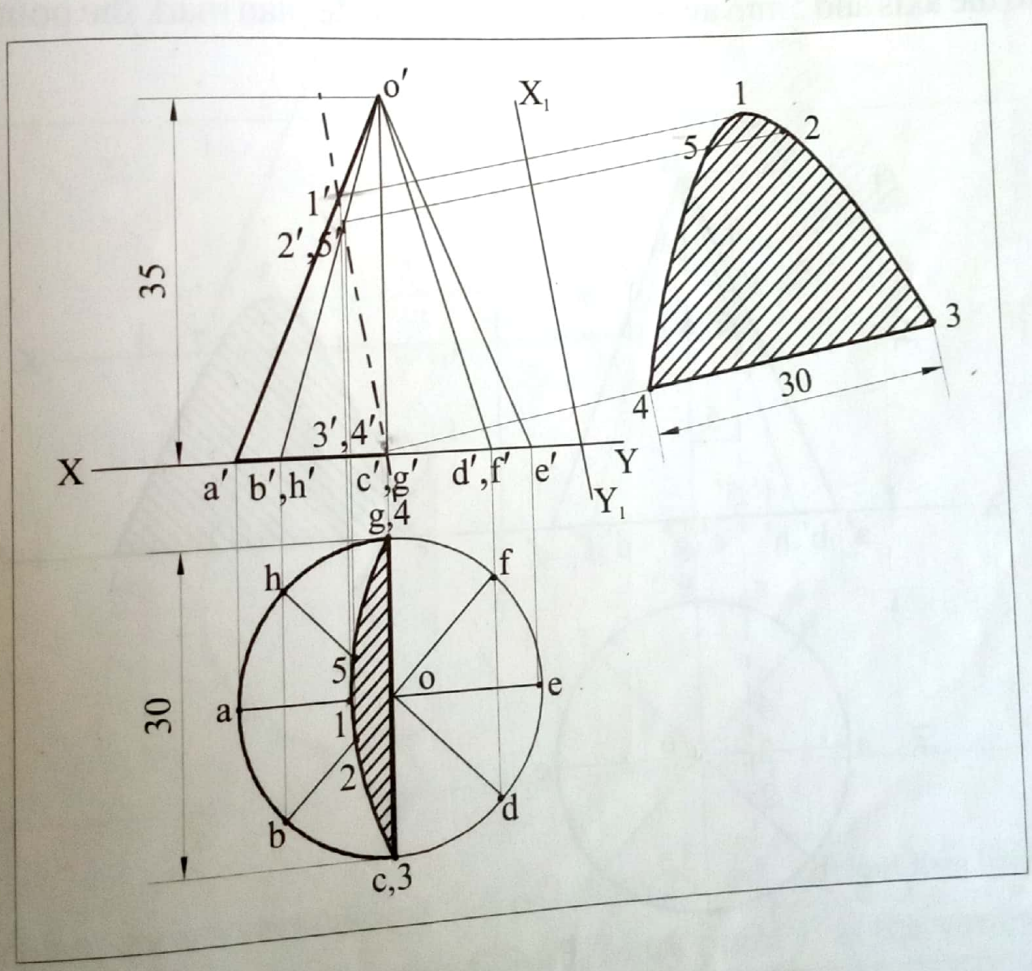

Fig. 4.12

be inclined to the other end generator. In the top view draw the vertical diameter and mark its end points as 3 and 4. Extend this line 3-4 to meet the elevation of base of cone at a point 3′, 4′. With this point as centre draw an arc of radius 25mm to cut the generator o′ a′ at 1′. Draw the vertical trace of the cutting plane passing through the points 1′ and (3′, 4′). Mark point 2′ on o′ b′and 5′ on o′ h′. Locate point 1 on oa, 2 on ob and 5 on oh. Join these points by smooth curve to get the top view of the section. Draw the true shape of the section which is a hyperbola as shown in Fig. 4.12.

Example 4.11.

A cone of base 30 mm diameter and axis height 35mm is kept with its base on HP. It is cut by a plane perpendicular to both HP and VP and 5mm away from the axis. Draw the plan, elevation and true shape of the section.

Solution.

Draw the plan and elevation of the cone. Draw the trace of cutting plane which is parallel to the axis and 5mm away from the axis. In the plan mark the point 1 on bc, 2

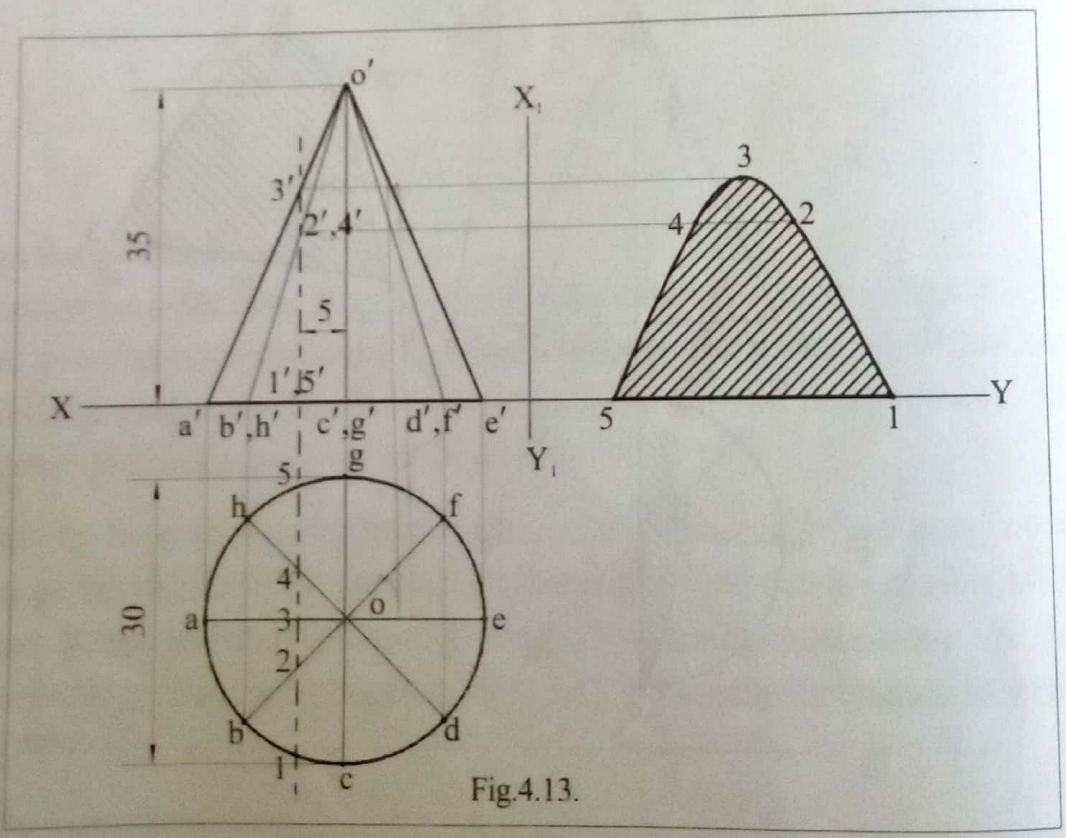

Fig.4.13.

on ob, 3 on oa, 4 on oh and 5 on gh. In the elevation locate the points 1′, 2′ etc. From these points draw horizontal lines and locate the points 1, 2, 3 etc. in the true shape such that the distance of point 1 in the true shape from X_1Y_1 line is the distance of point 1 in the plan from XY line. Similarly locate the other points 2, 3, 4 and 5 in the true shape. Join

these points by a smooth curve to get the true shape of the section which is a rectangular hyperbola.

Example 4.12.

A cone of base 30mm diameter and axis height 35mm is kept with its base on HP. It is cut by a plane perpendicular to VP such that the true shape of the section is an isosceles triangle of length of base 25mm. Draw the sectional plan and the true shape of the section.

Solution.

Draw the plan and elevation of the cone. The true shape of the section will be an isosceles triangle when the cutting plane cuts the base and passes through the apex of the

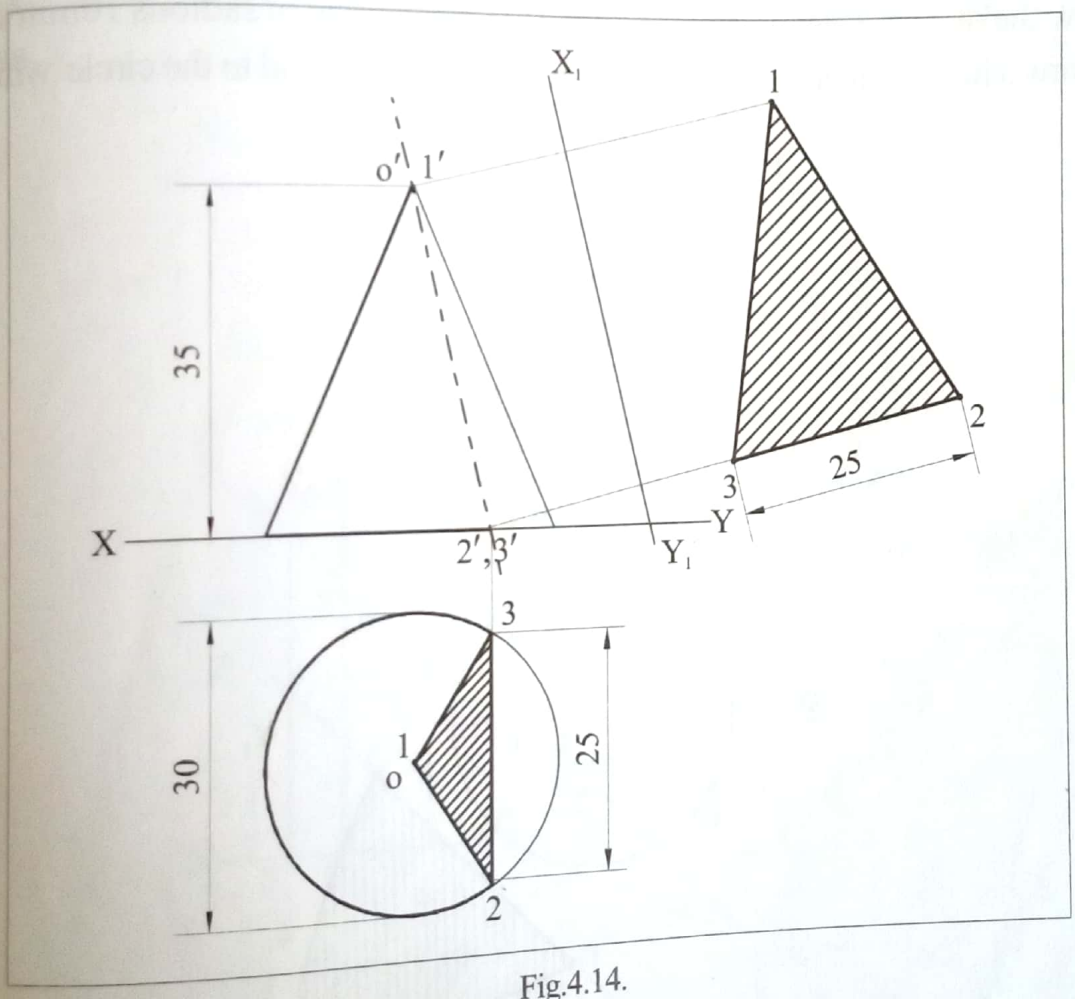

Fig.4.14.

cone. In the plan, draw a vertical line, 2-3 of length 25mm. Extend this line to meet the elevation of base of the cone at a point 2′, 3′. Mark point 1′ at the vertex. Draw the vertical trace of the cutting plane passing through the points (2′, 3′) and 1′. Locate point 1 in the plan which is at the top view of the vertex (centre of the circle). Join the points 1, 2 and 3 by straight lines. Draw the true shape of the section as shown in Fig. 4.14.

University question.

A cone of diameter of base 60mm and axis height 60mm rests with its base on HP. A section plane perpendicular to VP and inclined at 75° to HP passes through the apex of the cone. Draw the sectional top view and true shape of the section. [MGU 2007]

Example 4.13.

A cone of base diameter 60mm and axis 70mm is resting upon its base on HP. It is cut by a vertical plane which makes an angle of 45° with VP and is 10mm away from the axis. Draw the sectional front view showing the section and true shape of the section.

Solution.

Draw the plan and elevation of the cone. Draw a circle of radious 10mm with o as center.Draw a line inclined at 45° with horizontal and tangential to the circle which is the

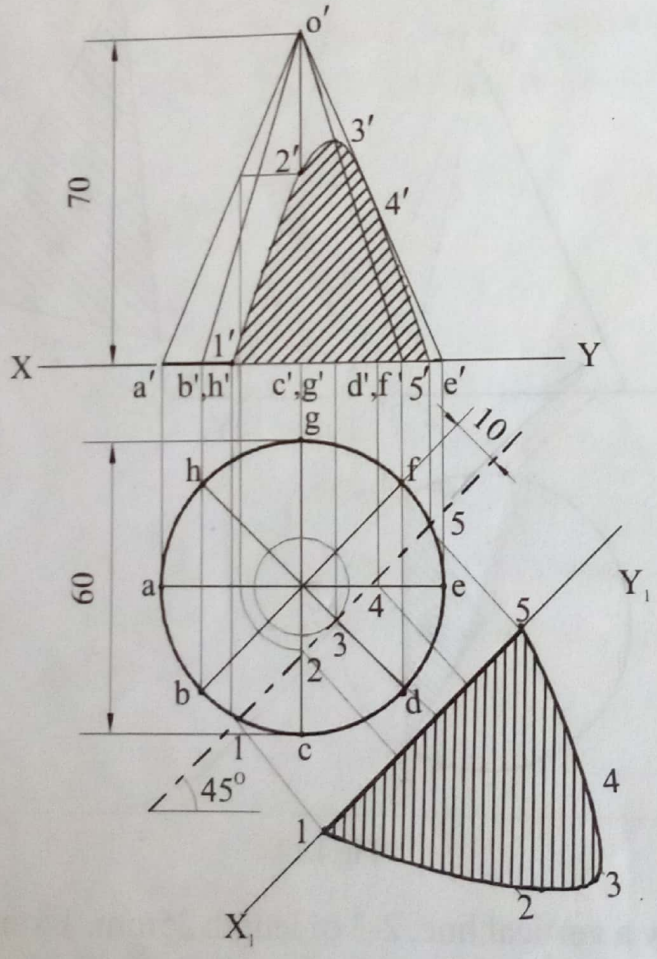

Fig. 4.15

required horizontal trace of the cutting plane. Mark point 1 on bc, 2 on oc, 3 on od, 4 on oe and 5 on ef. Locate 1′ on b′ c′, 2′ on o′ c′, 3′ on o′ d′, 4′ on o′ e′ and 5′ on e′ f′. Join these points by a smooth curve which is the elevation of the section. Draw the true shape of the section as shown in Fig. 4.15.

University question.

A right circular cone of 100mm base circle diameter and 50mm height is resting on its base on the ground. It is cut by a vertical plane inclined at 40° to the VP, the plane being at minimum distance of 15mm from the axis of the cone. Draw the sectional elevation and project the true shape of the section. [KU May 2009].

Example 4.14.

A pentagonal prism, having a base with a 35mm side and a 70mm long axis, is resting on its base on HP such that one of the rectagular faces is parallel to the VP. It is cut by an auxiliary inclined plane making an angle 45° with the HP and passes through the midpoint of the axis. Draw the sectional top view and the true shape of the section.

Solution.

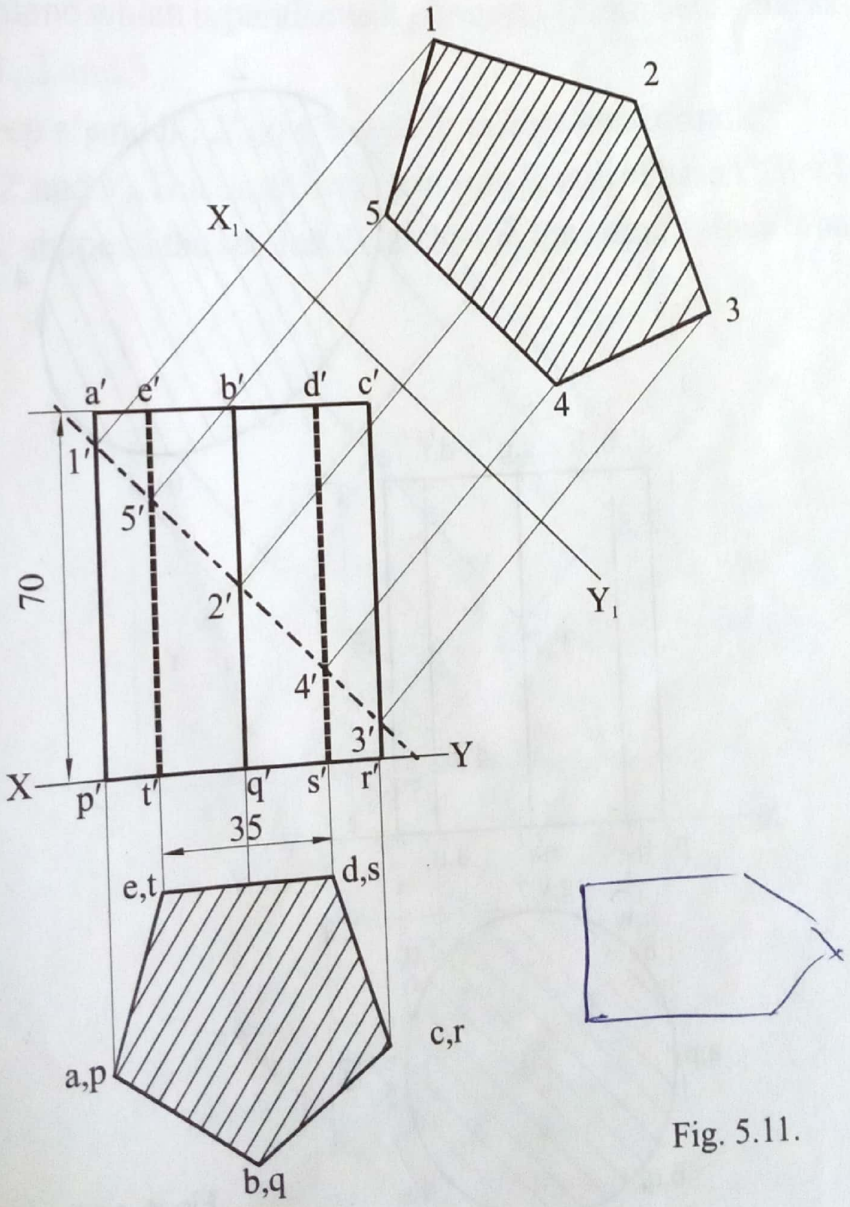

Fig. 5.11.

1. Draw the xy line and draw the plan and elevation of the prism.
2. Draw the vertical trace of the section plane, inclined at 45^0 with xy line and passing though the mid point of the axis.
3. Mark the points 1′ on a′p′, 2′ on b′q′, 3′ on c′r′, 4′ on d′s′ and 5′ on e′t′
5. Mark opoints 1, 2, 3, 4 and 5 in the top view.
6. Draw the true shape of the section.

Problem 4.1

A cylinder of diameter 50mm and length of axis 65mm rests on its base with the axis perpendicular to the HP. It is cut by the cutting plane perpendicular to the VP, inclined at 45^0 to the HP and passing through a point on axis 25mm from the top. Draw the front view, the sectional top view and the true shape of the cut surface.

Solution

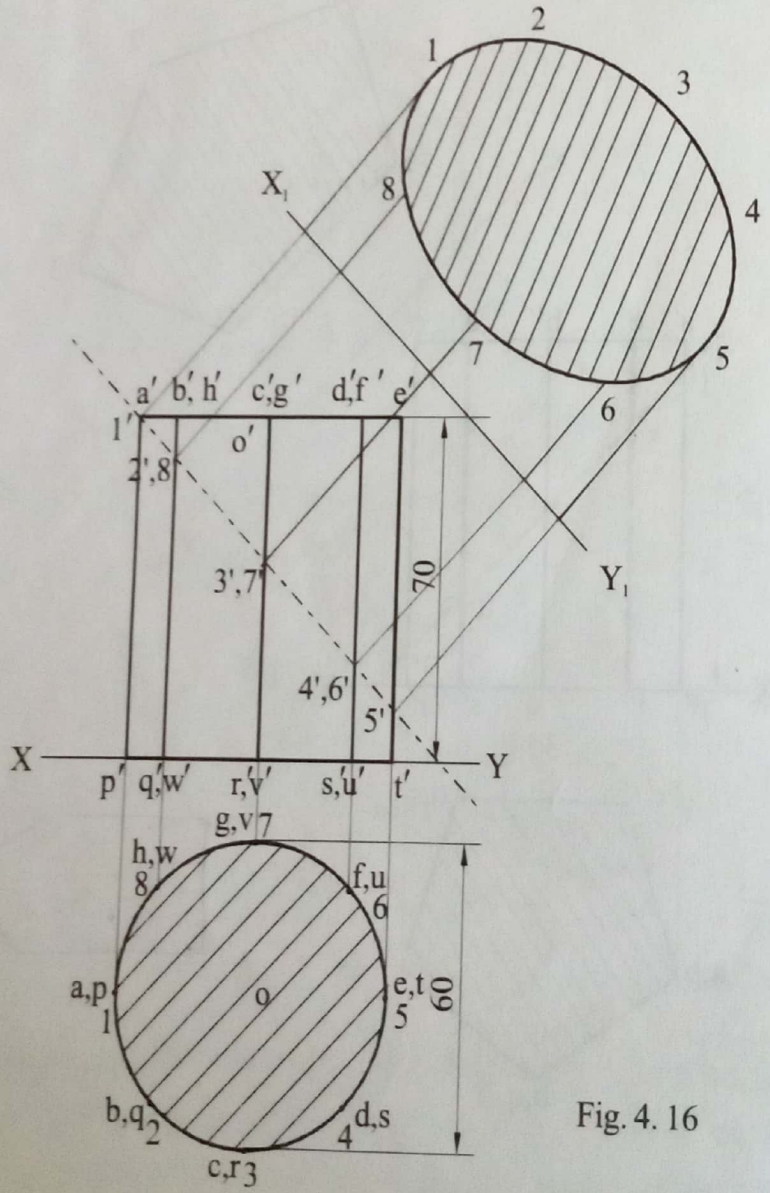

Fig. 4. 16

1. Draw the xy line and draw the plan and elevation of the cylinder.
2. Locate a point on the axis 25mm below its top end and through this point draw a line inclined at 45° with horizontal.
3. Mark the points 1′, 2′ 3′ etc in the elevation and the point 1, 2, 3 etc in the plan.
4. Draw the true shape of the section as shown in Fig. 4.16.

Problem 4.2 → check

A square pyramid side of base 50mm and axis height 70mm is kept with its base on HP with all the base edges equally inclined to VP. It is cut by a section plane perpendicular to HP, parallel to VP and 15mm away from the axis. Draw the sectional plane and elevation of the pyramid.

Solution

1. Draw the XY line and draw the plan and elevation of the pyramid.
2. Draw the section plane which is parallel to xy line and 15mm below the axis.
3. Mark the points 1, 2 and 3.
4. Mark 1′ in between a′ and b′, 2′ on o′b′ and 3′ in between b′ and c′
5. Joint the points 1′2′ and 3′. This isosles triangle with length of base 1′-3′ = 1-3 in the top view itself is the true shape of the section. It is because the cutting plane is parallel to VP.

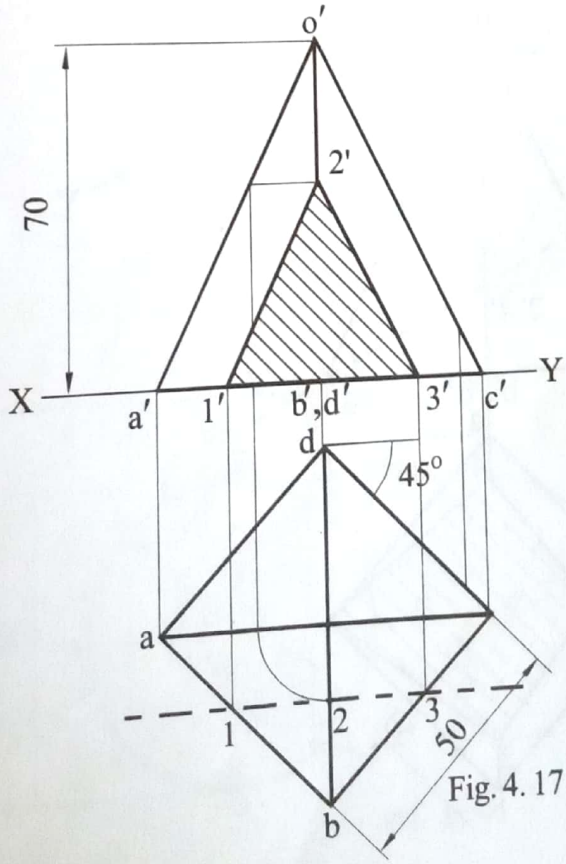

Fig. 4. 17

Problem 4.3

A square pyramid side of base 50mm and axis height 70mm is kept with its base on HP. It is cut by a section plane perpendicular to VP which contains one of the base corners and is perpendicular to the slant edge opposite to this base corner. Draw the sectional plan elevation and true shape of the section.

Solution

1. Draw the XY line and draw the plan and elevation.
2. Draw the section line through the point c′ (base corner) and perpendicular to the line o′a′ (slant edge)
3. Mark the points 1′ ,2′,3′ and 4′
4. Mark the points 1,2,3 and 4 in the top view, 1 on line oa, 2 on line ob and 3 at c and 4 on od. Join these points.
5. Draw the true shape of the section as shown in Fig. 4.18.

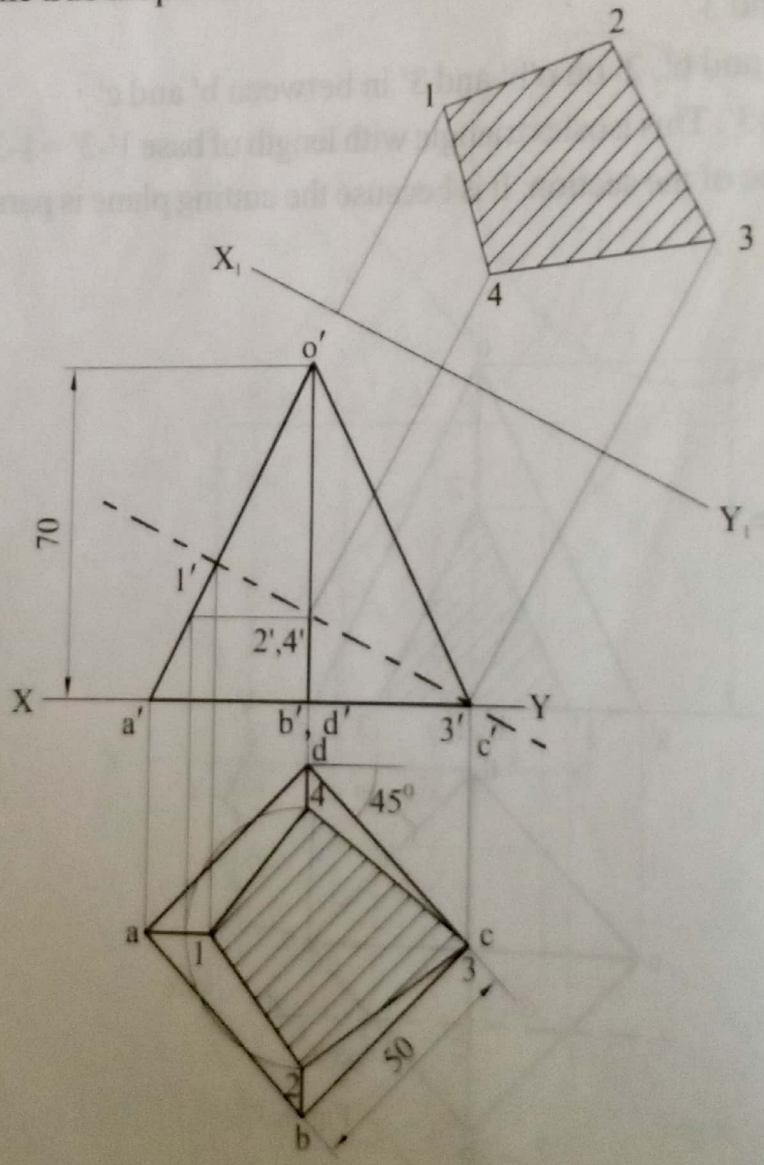

Fig. 4. 18

Problem 4.4

A right circular cone of base diametre 60mm is cut by a section plane such that the shape of the section is a parabola of maximum double ordinate 50mm and vertex of the parabola is 60mm from the ordinate. Draw the front view,sectional top view and true shape of the section.

Solution

1.Draw the XY line and draw the plan of the cone and the elevation of the base of the cone.

2.Mark the points a,b,c, etc in the plan and the points a′, b′, c′ etc.in the elevation of the base of the cone.

3.Draw a vertical line in the plan of length equal to the required double ordinate of the parabola (50mm).

4.Extend this line to meet the XY line at a point.With this point and a′ as centers and radius 60mm draw arcs to meet at a point.

5.Join a′ and this point and extend it to meet the vertical line from o_1' at o′.

6.Join the located point in the base of the cone and the located point in the line a′ o′.This line is the vertical trace of the cutting plane.

7.Complete the problem as explined in example 4.9.

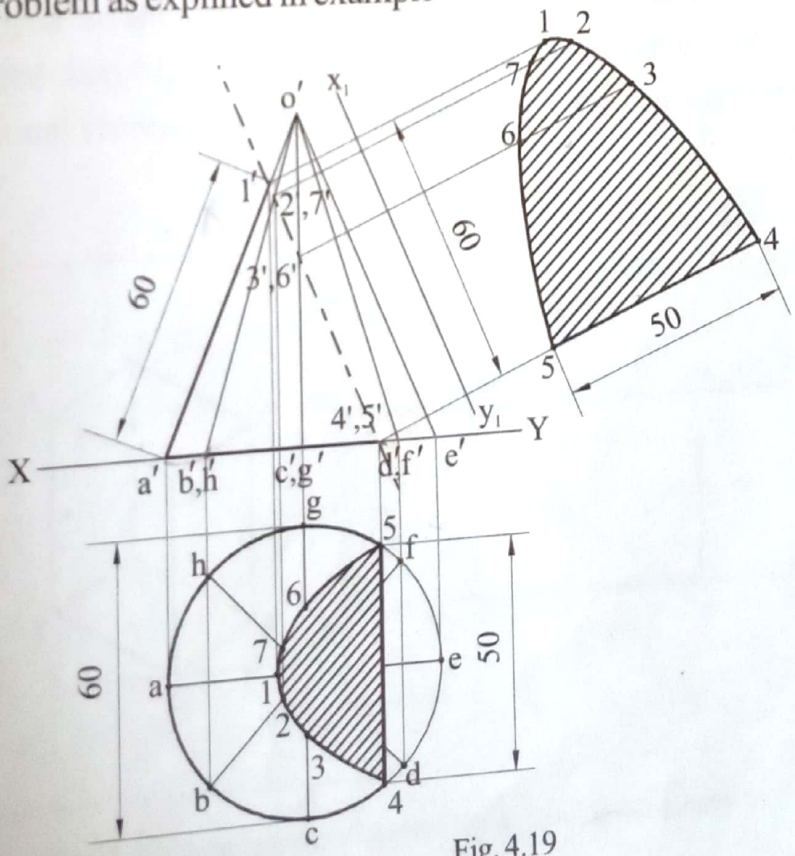

Fig. 4.19