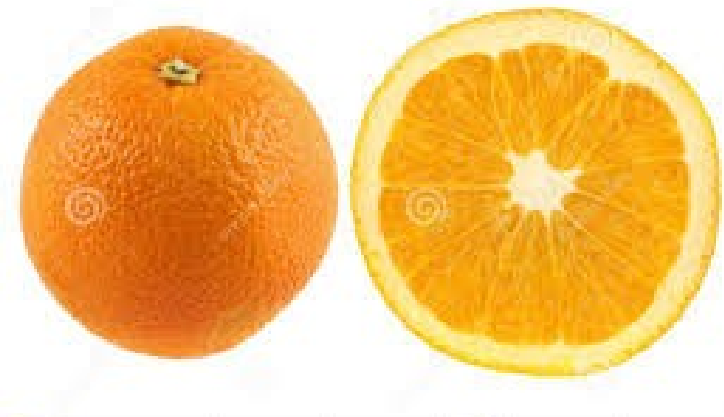


GE8152

ENGINEERING GRAPHICS

Ravi Sivaprakash AP/MECH AAMEC Kovilvenni



UNIT IV

PROJECTION OF SECTIONED SOLIDS



Definitions

Cutting plane or section plane :

The imaginary plane which is assumed to cut the object as required is called a cutting plane or section plane.

Section :

The surface produced when a section plane cuts a solid is termed a section.

Definitions

Sectional view :

The drawing showing that part of the object which is between the plane of projection and the section plane is called a sectional view.

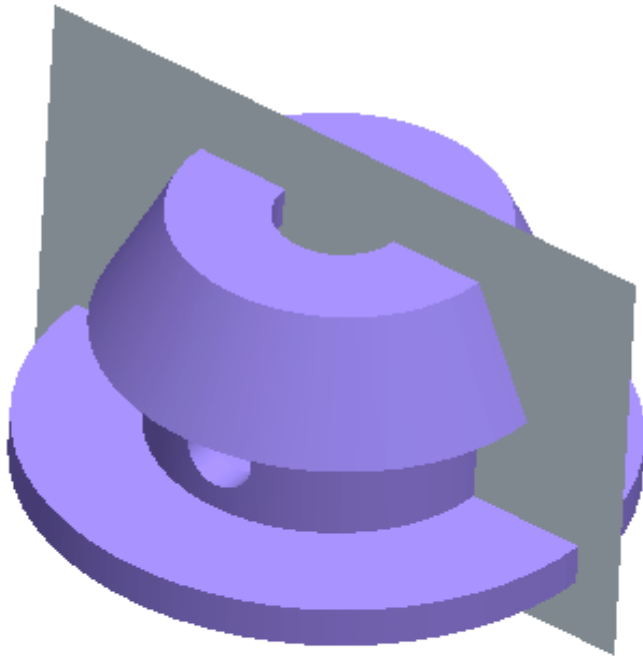
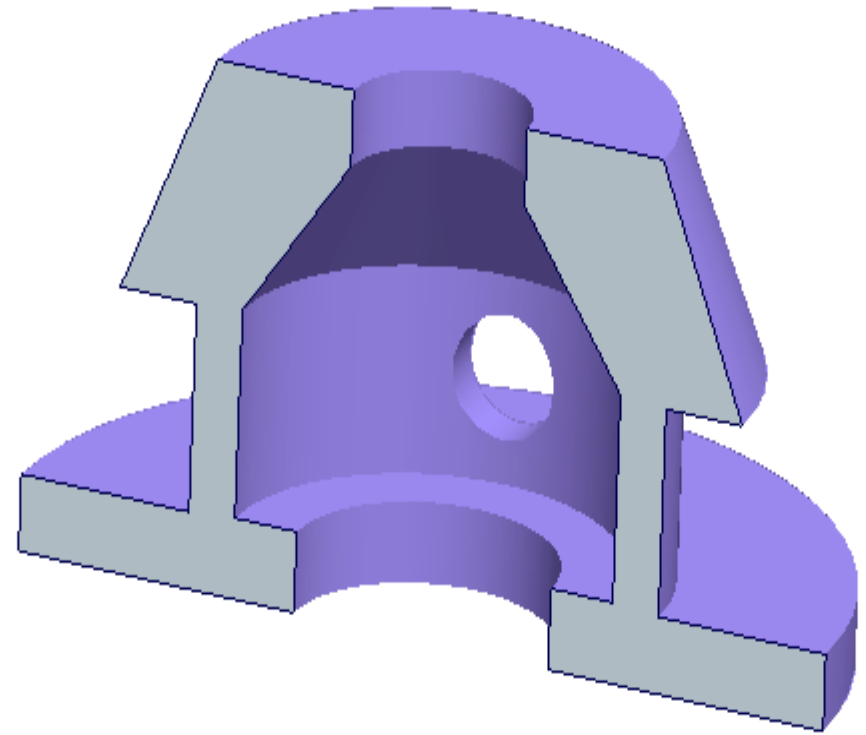
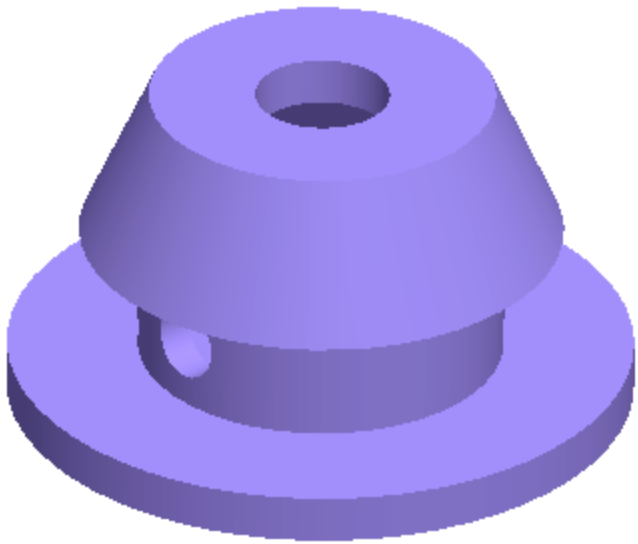
True Shape of Section :

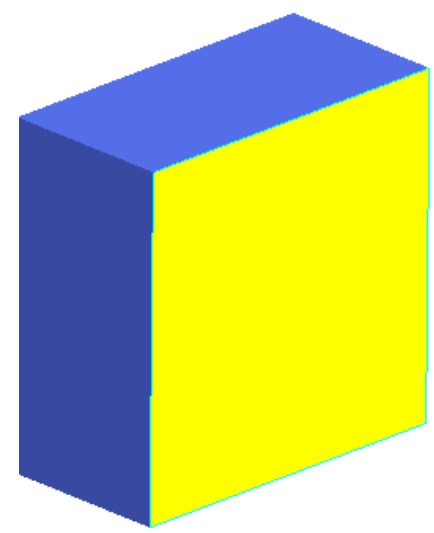
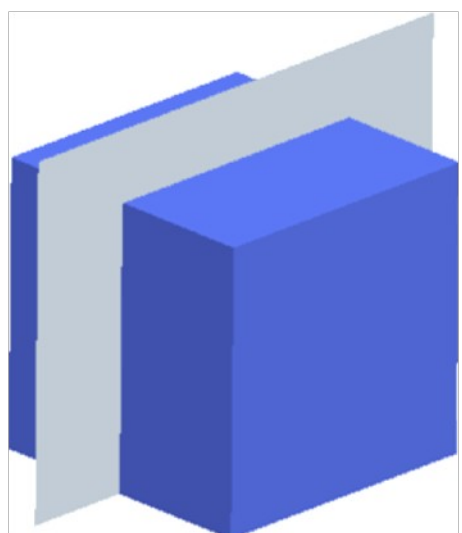
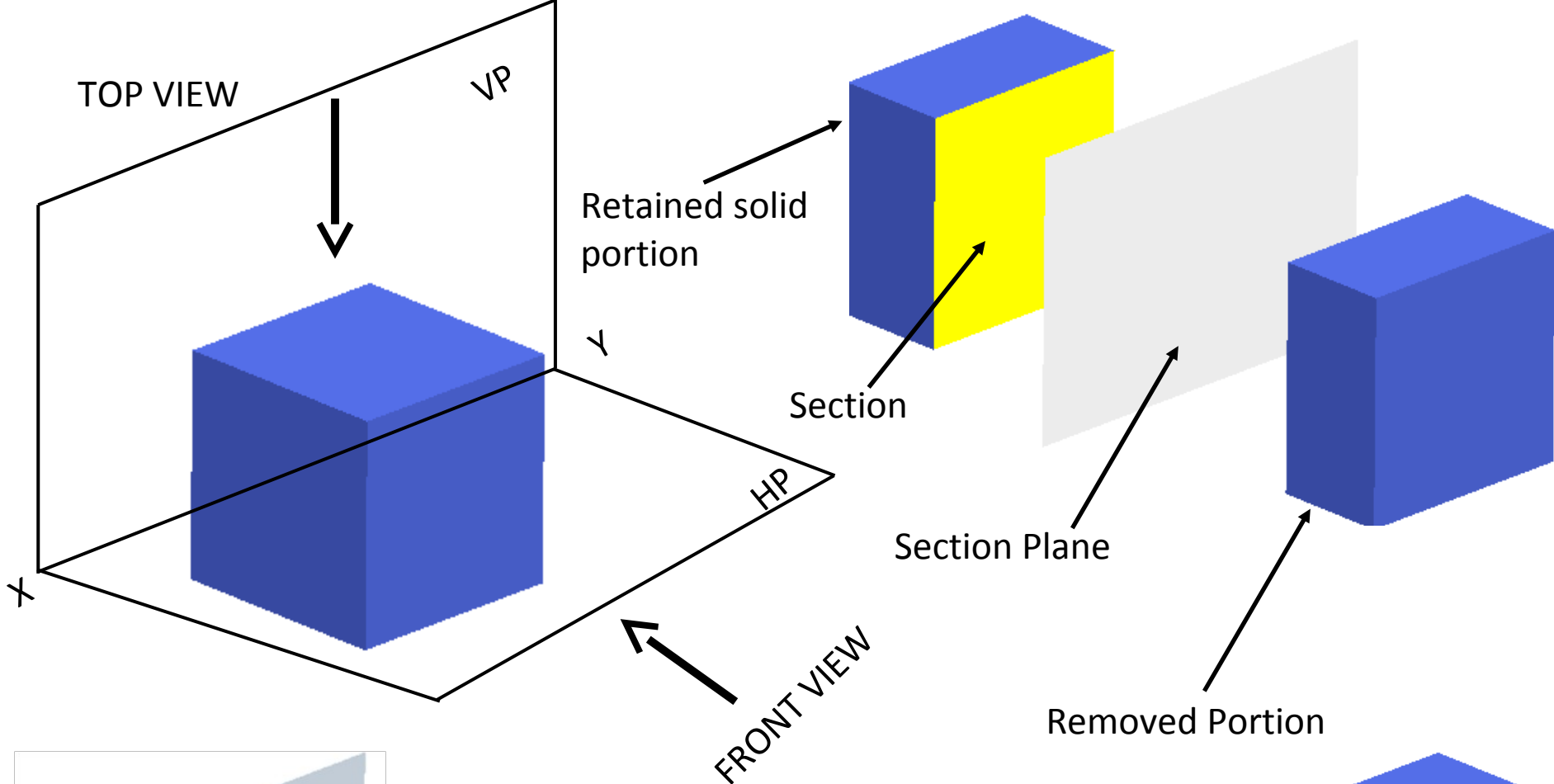
If a solid is sectioned by a section plane and it is projected to a plane parallel to it, the shape of the section obtained will be exactly the section exposed by the section plane. This shape is called True Shape of Section.

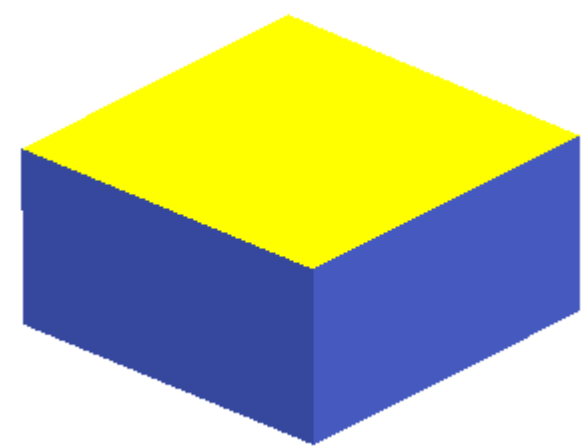
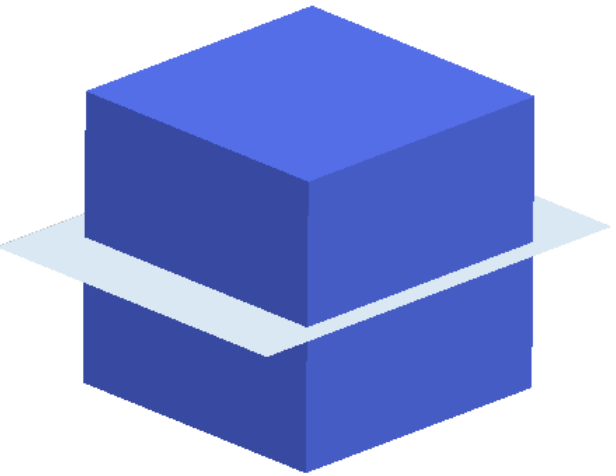
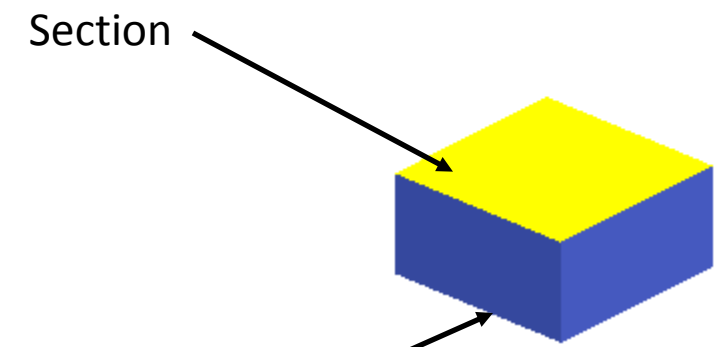
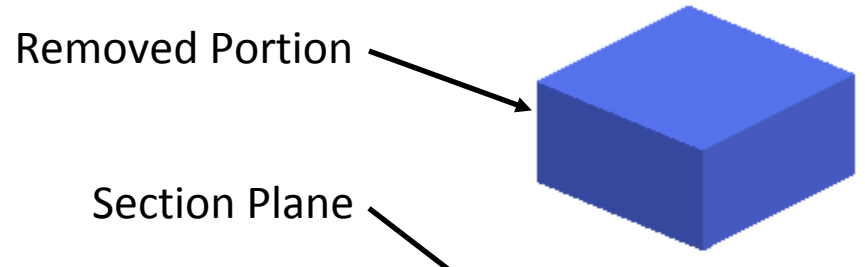
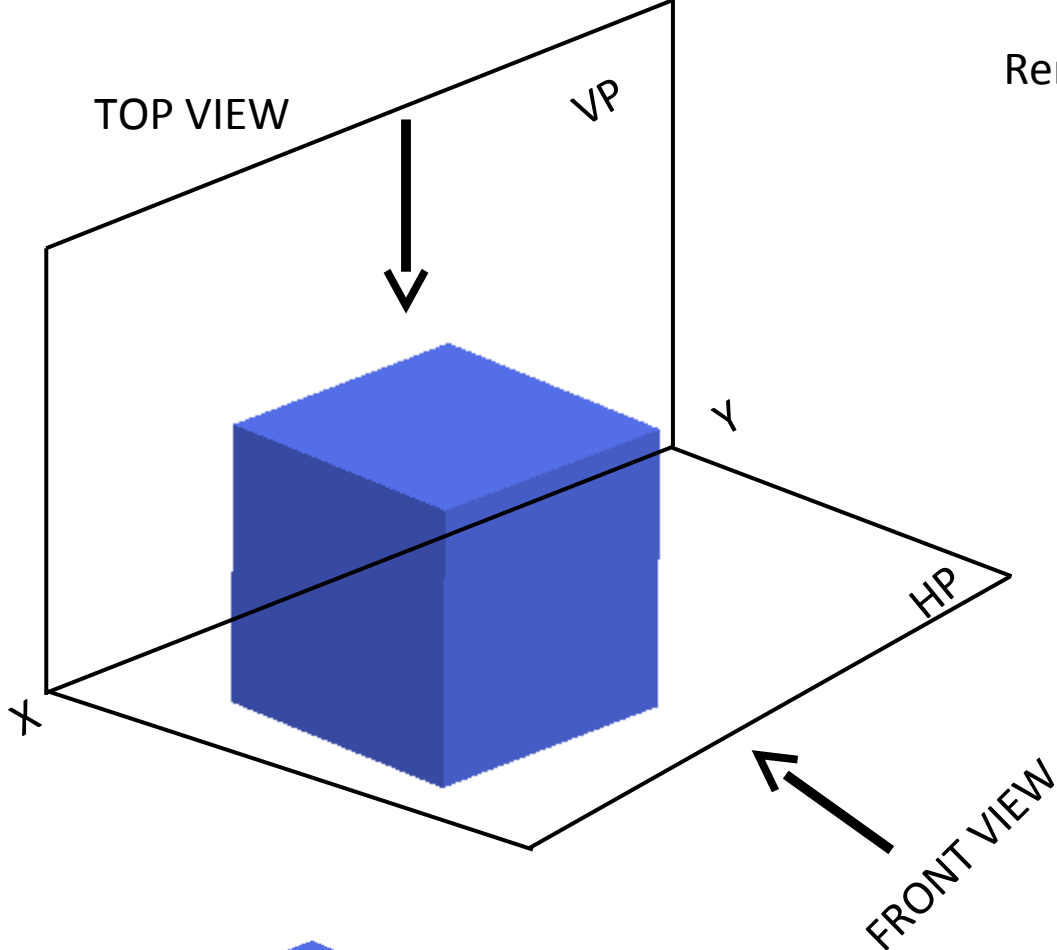
Definitions

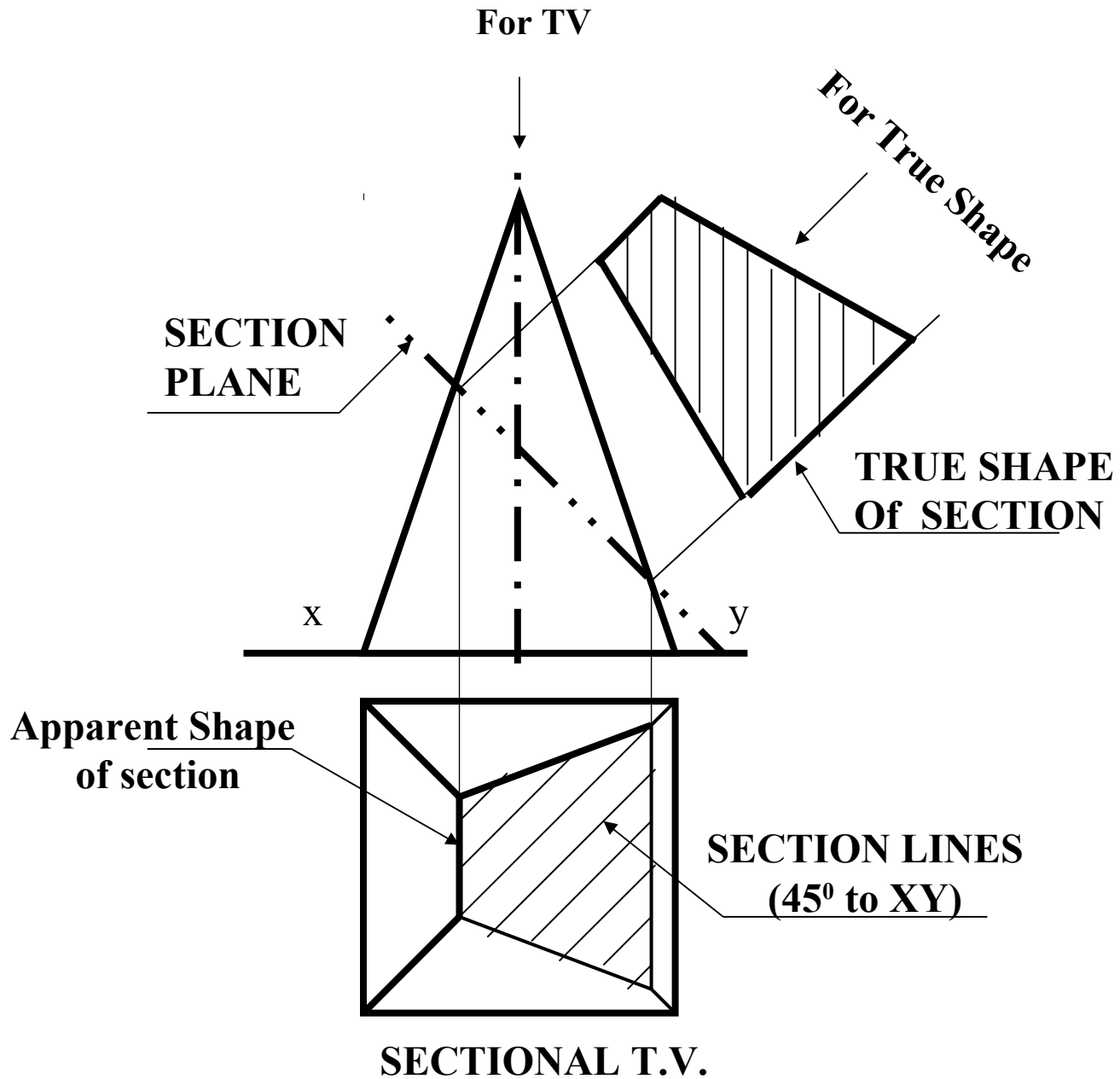
Apparent Shape of Section :

If the section plane is inclined to the plane of projection, the shape obtained will not be the true shape. Such a shape is called Apparent Shape of Section.







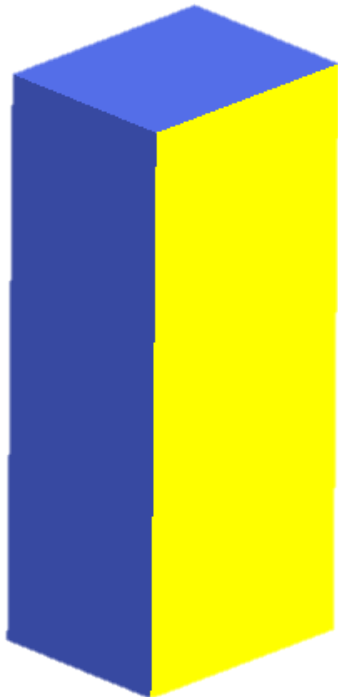
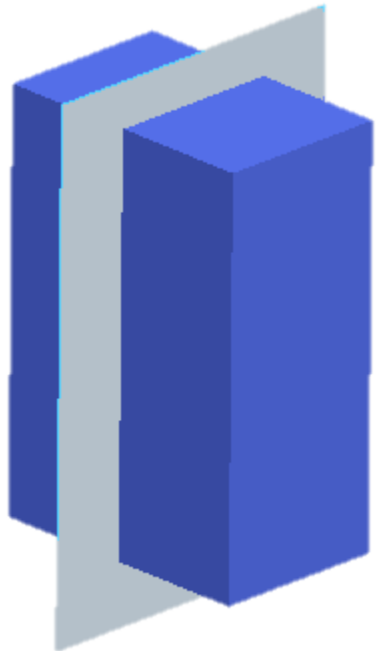
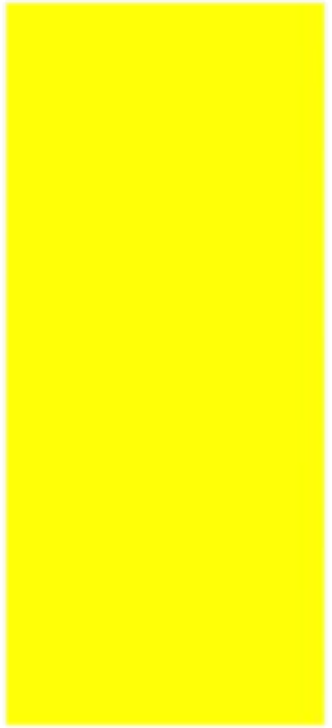
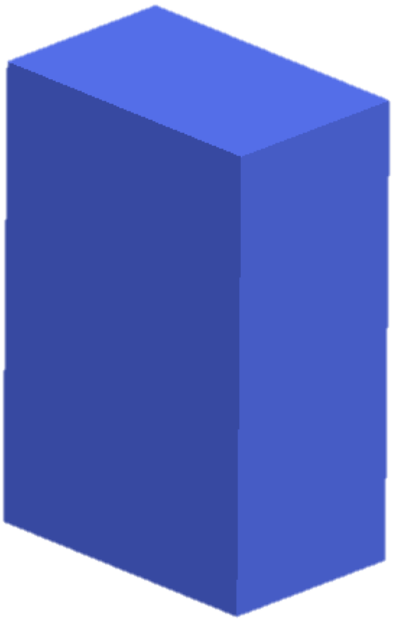


Types of Section Planes

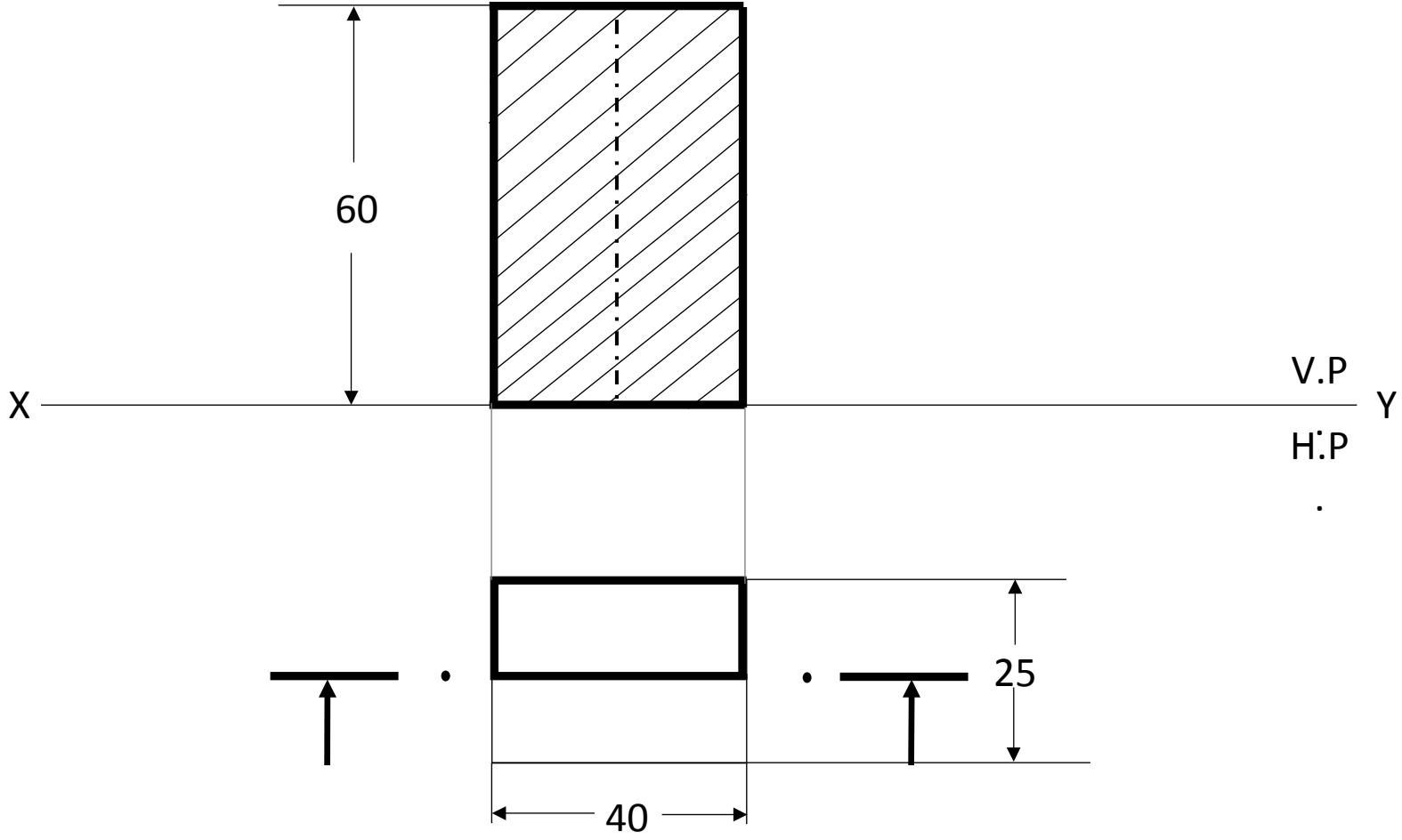
1. Section Plane Perpendicular to HP and parallel to VP.
2. Section Plane Perpendicular to VP and parallel to HP.
3. Section Plane Perpendicular to VP and Inclined to HP.
4. Section Plane Perpendicular to HP and Inclined to VP.
5. Section Plane Perpendicular to both HP and VP.

Problem 1

A **rectangular prism**, side of base 40 mm X 25 mm and height 60 mm, rests with its base on HP such that one of its larger rectangular faces is parallel to VP. A section plane perpendicular to HP and parallel to VP cuts the prism into two equal halves. Draw its top view and sectional front view.

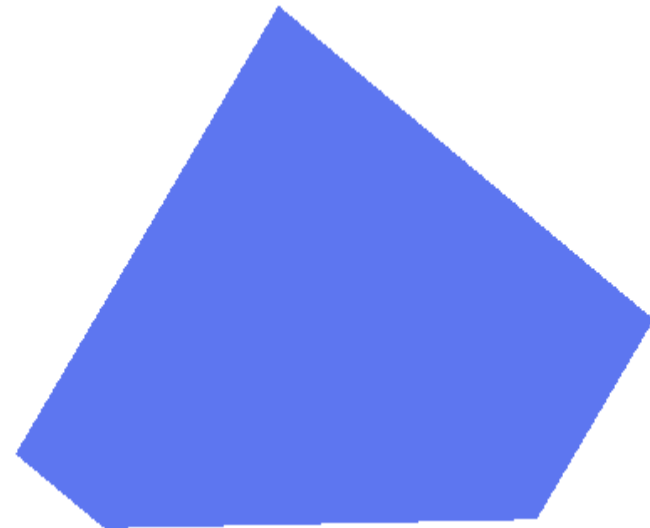
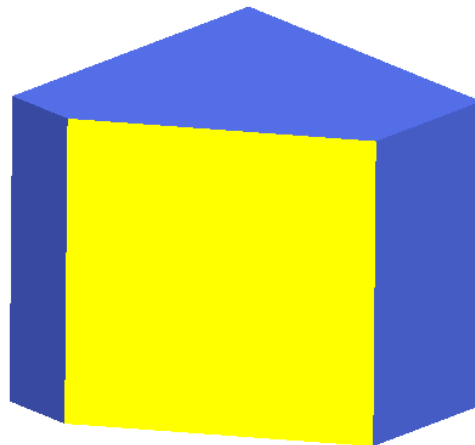
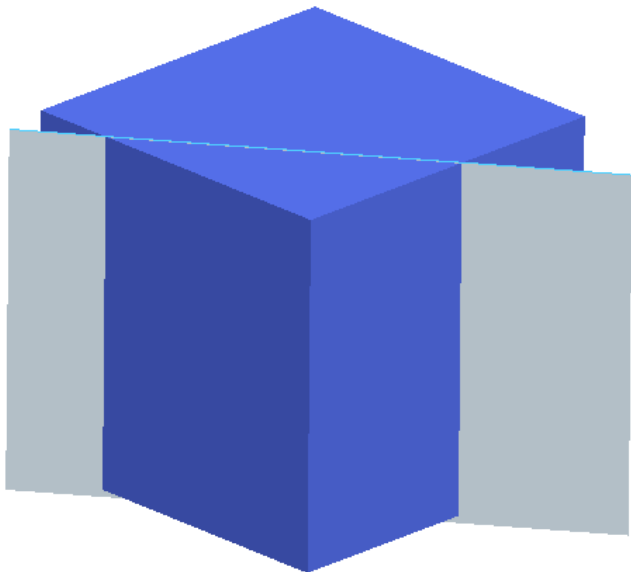
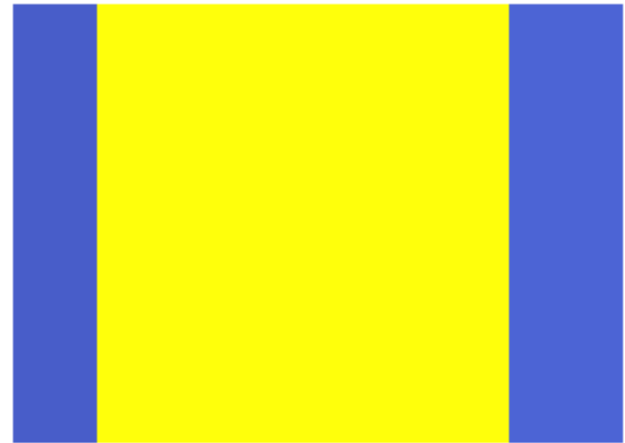
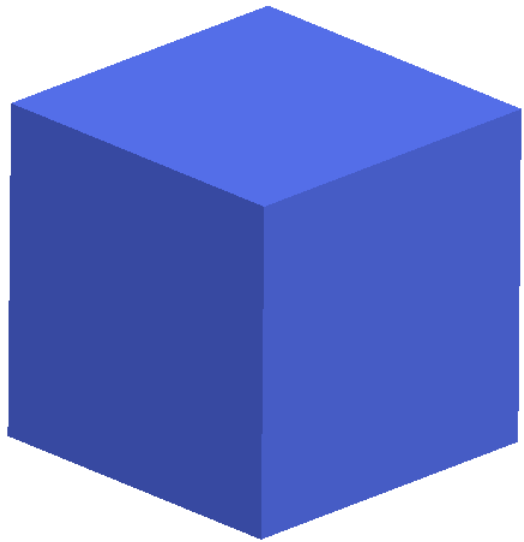


Problem 1



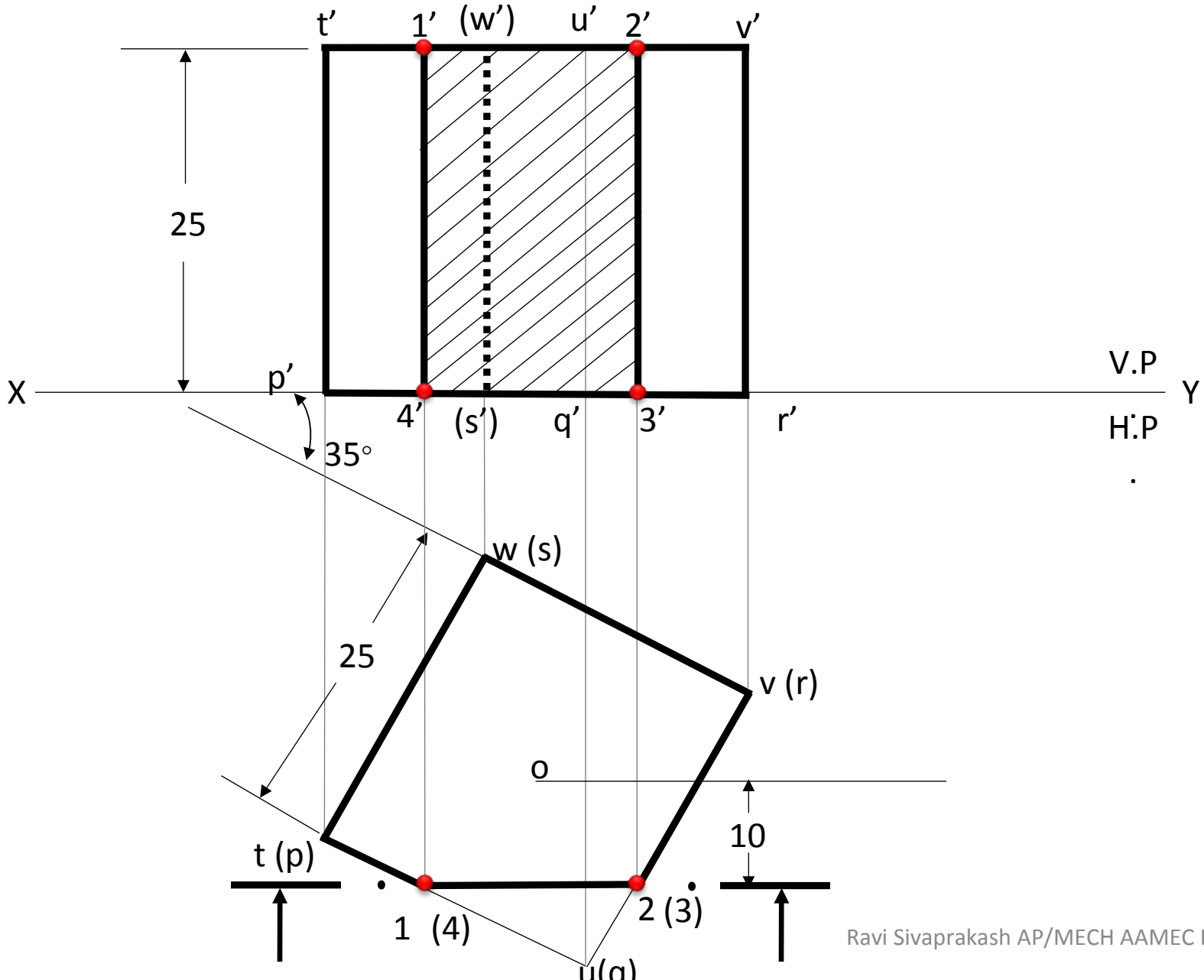
Problem 2

A **cube** of side 25 mm rests on the HP on one of its faces with a vertical face inclined at 35° to the VP. A plane perpendicular to the HP and parallel to the VP cuts the cube 10 mm away from the axis and farther away from the VP. Draw the top view and the sectional front view.



Problem 2

Draw the top view as a square of side 40 mm with one of its sides inclined at 35° to xy .



Problem 3

A **cube** of side 30 mm rests on the HP on its end with the vertical faces equally inclined to the VP. It is cut by a plane perpendicular to the VP and inclined at 30° to the HP meeting the axis at 25 mm above the base. Draw its front view, sectional top view and the true shape of the section.

Problem 3

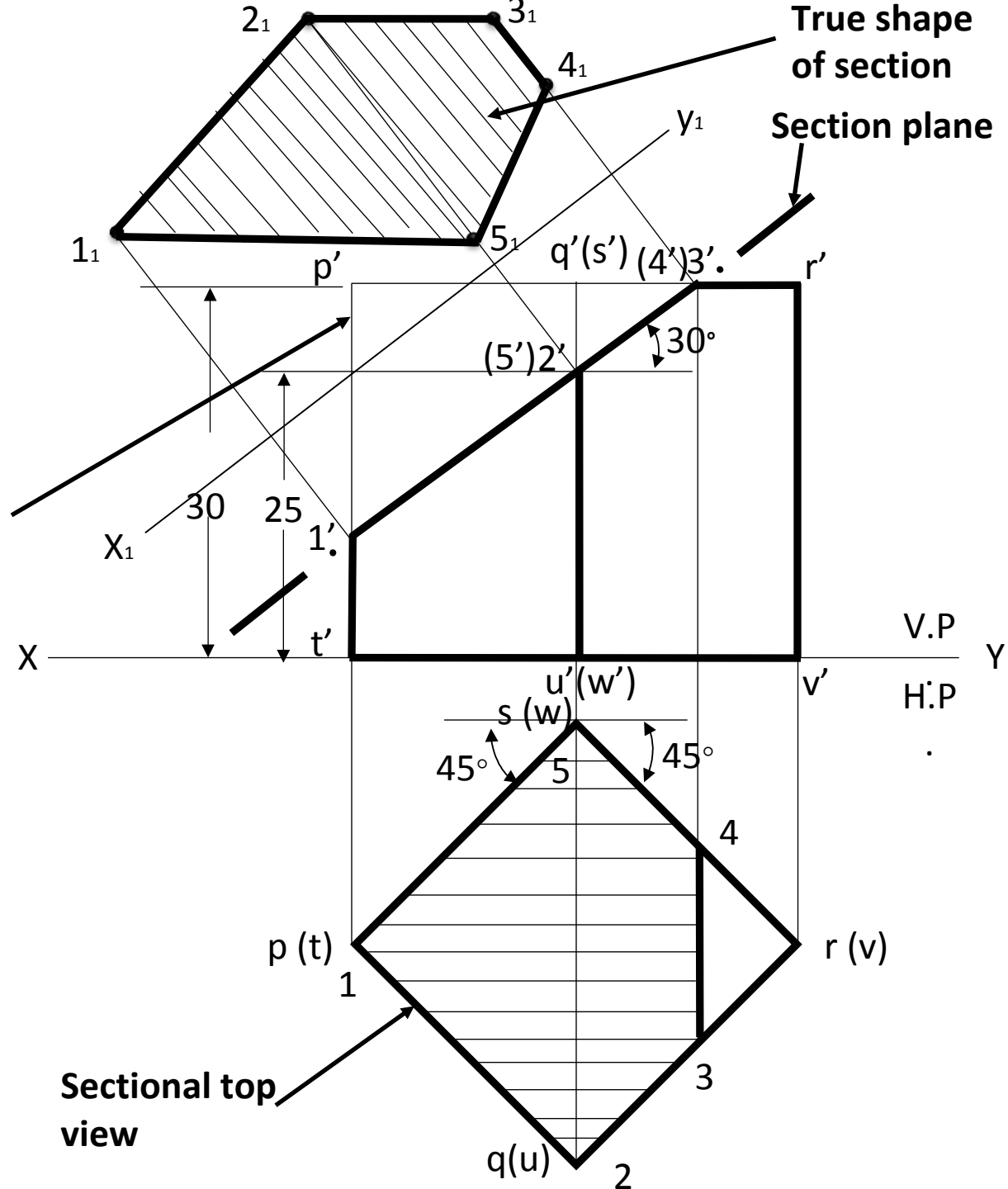
Faces equally inclined to the VP.

Draw another reference line X_1Y_1 parallel to the section plane.

Draw projectors perpendicular to X_1Y_1 from $1', 2', 3', (4'), (5')$

Removed Portion

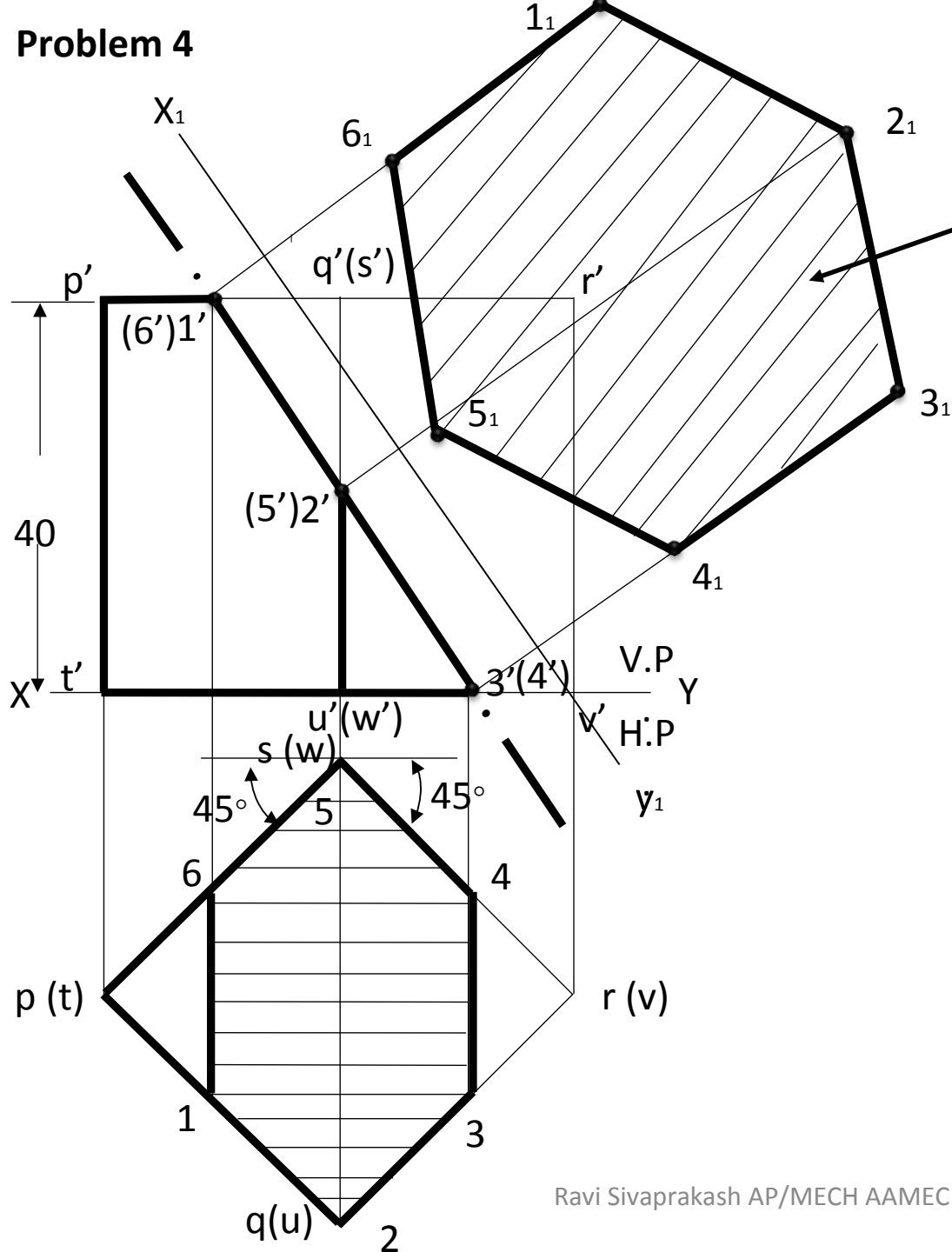
- The distance of 1_1 from $X_1Y_1 = t'-1$
- The distance of 2_1 from $X_1Y_1 = u'-2$
- The distance of 3_1 from $X_1Y_1 = XY -3$
- The distance of 4_1 from $X_1Y_1 = XY -4$
- The distance of 5_1 from $X_1Y_1 = u'-5$



Problem 4

A **cube** of side 40 mm is placed and cut by a plane in such a way that the true shape of the section is a regular hexagon. Draw the front and top views of the cube and determine the inclination of the plane with the HP.

Problem 4



True shape of section

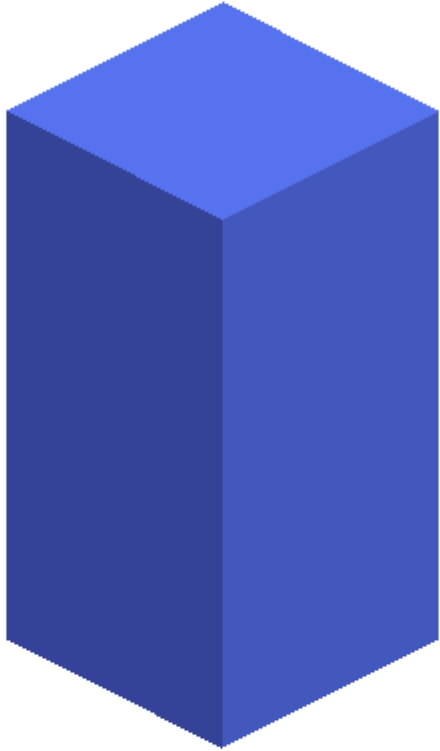
The mid-points of $p'q'$ are marked as $1'$
 The mid-points of $q'u'$ are marked as $2'$
 The mid-points of $u'v'$ are marked as $3'$

Draw projectors perpendicular to X_1Y_1 from $1', 2', 3', 4', 5'$

- The distance of 1_1 from $X_1Y_1 = XY - 1$
- The distance of 2_1 from $X_1Y_1 = XY - 2$
- The distance of 3_1 from $X_1Y_1 = XY - 3$
- The distance of 4_1 from $X_1Y_1 = XY - 4$
- The distance of 5_1 from $X_1Y_1 = XY - 5$
- The distance of 6_1 from $X_1Y_1 = XY - 6$

Problem 5

A **square prism** of base side 30 mm and height 60 mm 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° to the HP** meeting the axis at 15 mm from the top. Draw its front view, sectional top view and the true shape of the section.



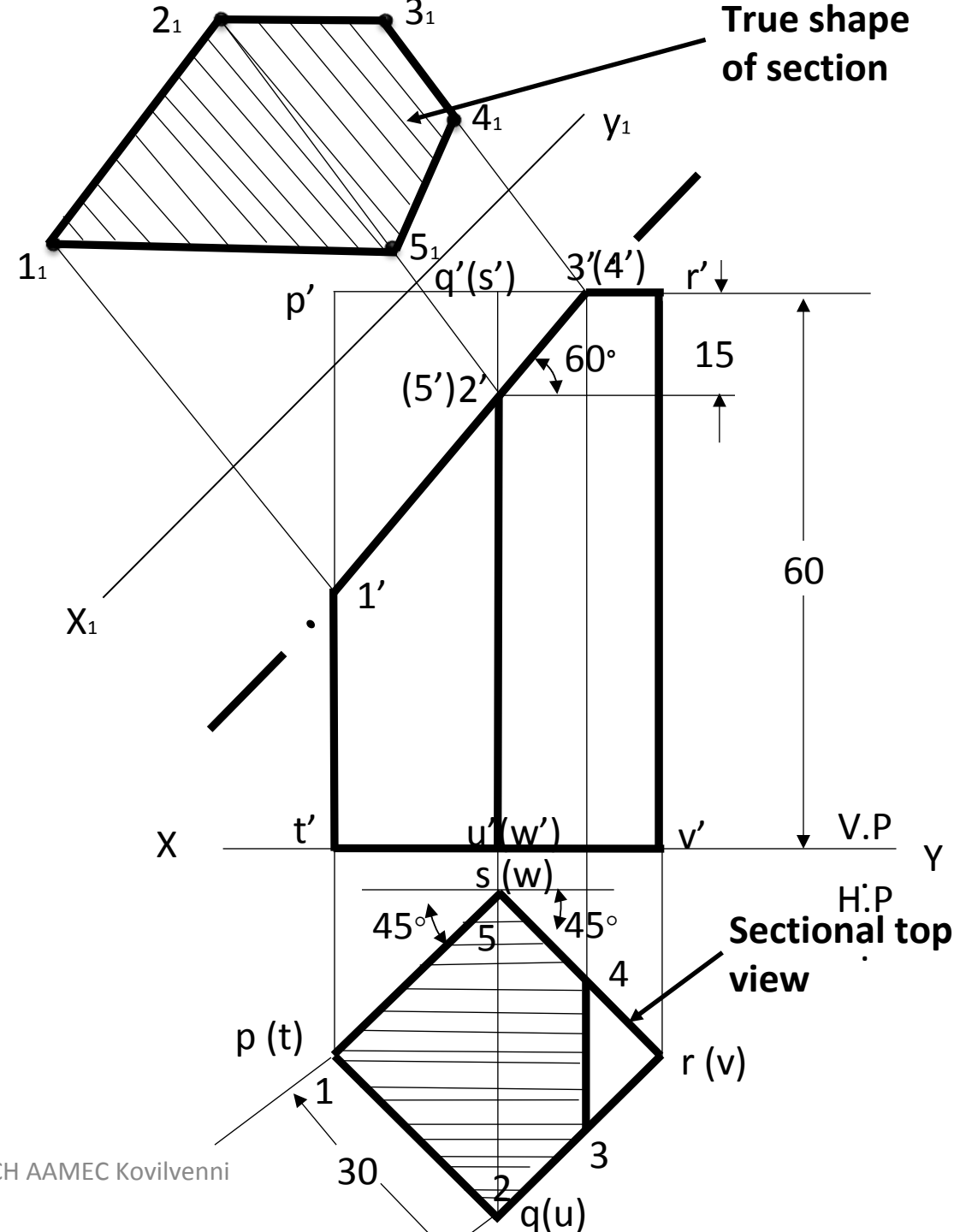
Problem 5

Faces equally inclined to the VP.

Draw another reference line X_1Y_1 parallel to the section plane.

Draw projectors perpendicular to X_1Y_1 from $1', 2', 3', (4'), (5')$

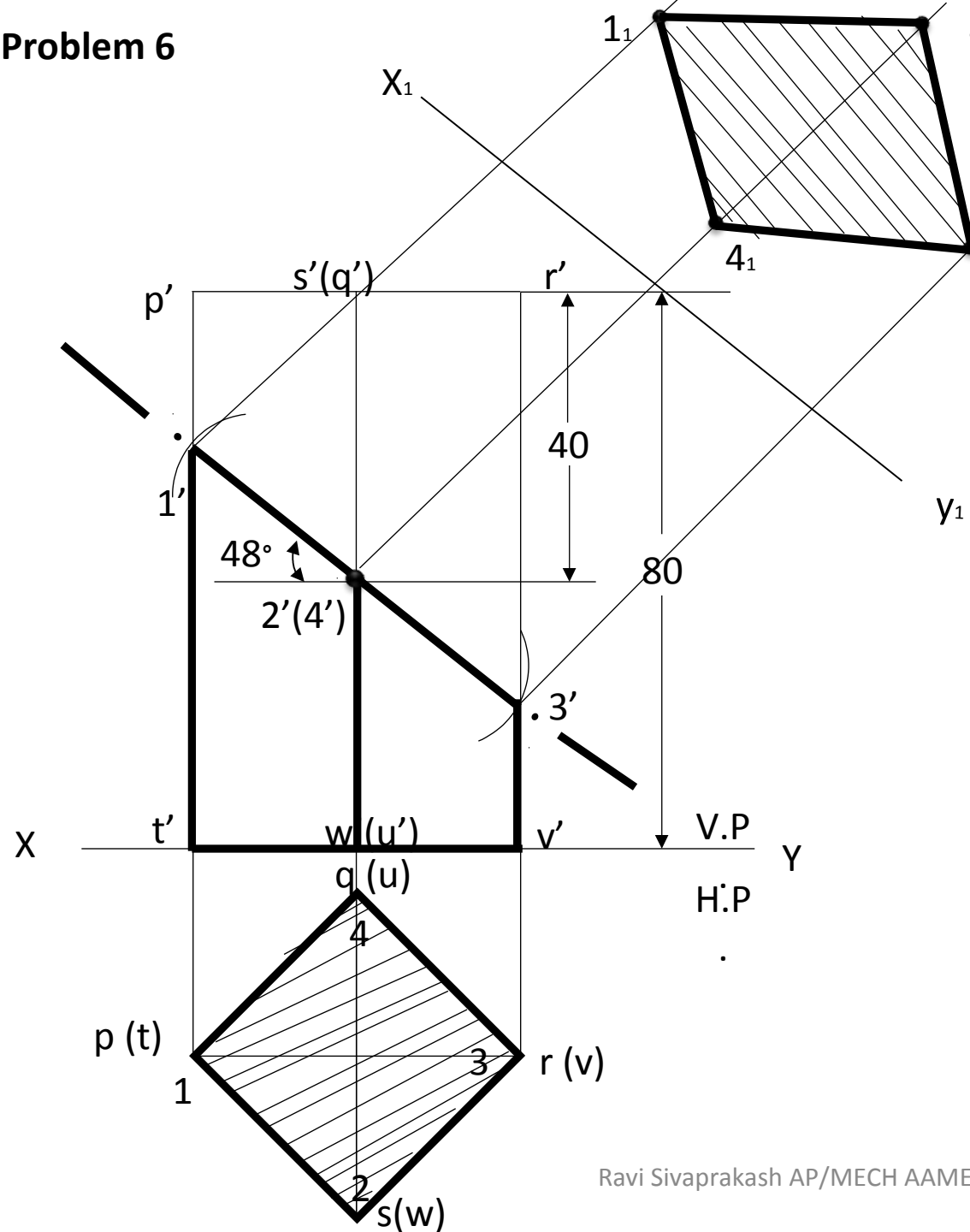
- The distance of 1_1 from $X_1Y_1 = t'-1$
- The distance of 2_1 from $X_1Y_1 = u'-2$
- The distance of 3_1 from $X_1Y_1 = XY -3$
- The distance of 4_1 from $X_1Y_1 = XY -4$
- The distance of 5_1 from $X_1Y_1 = u'-5$



Problem 6

A **square prism** of height 80 mm and base of diagonal 40 mm rests on the HP on its base with base edges equally inclined to the VP. It is cut by a section plane passing through the mid-point of the axis of the prism perpendicular to the VP and inclined to the HP. Find the inclination of the cutting plane if the **true shape** of the section is a **rhombus** of diagonals 60 mm and 40 mm.

Problem 6



Draw the top and front views of the prism with its base edges equally inclined to the VP. **pr=qs=40 mm.**

Locate the mid-point of the axis in the front view.

With 2' as centre and half of the longer diagonal of the rhombus forming the true shape (30 mm) as radius, draw arcs cutting the extreme vertical edges at 1' and 3'.

- The distance of 1₁ from X₁Y₁ = t'-1
- The distance of 2₁ from X₁Y₁ = u'-2
- The distance of 3₁ from X₁Y₁ = XY -3
- The distance of 4₁ from X₁Y₁ = XY -4

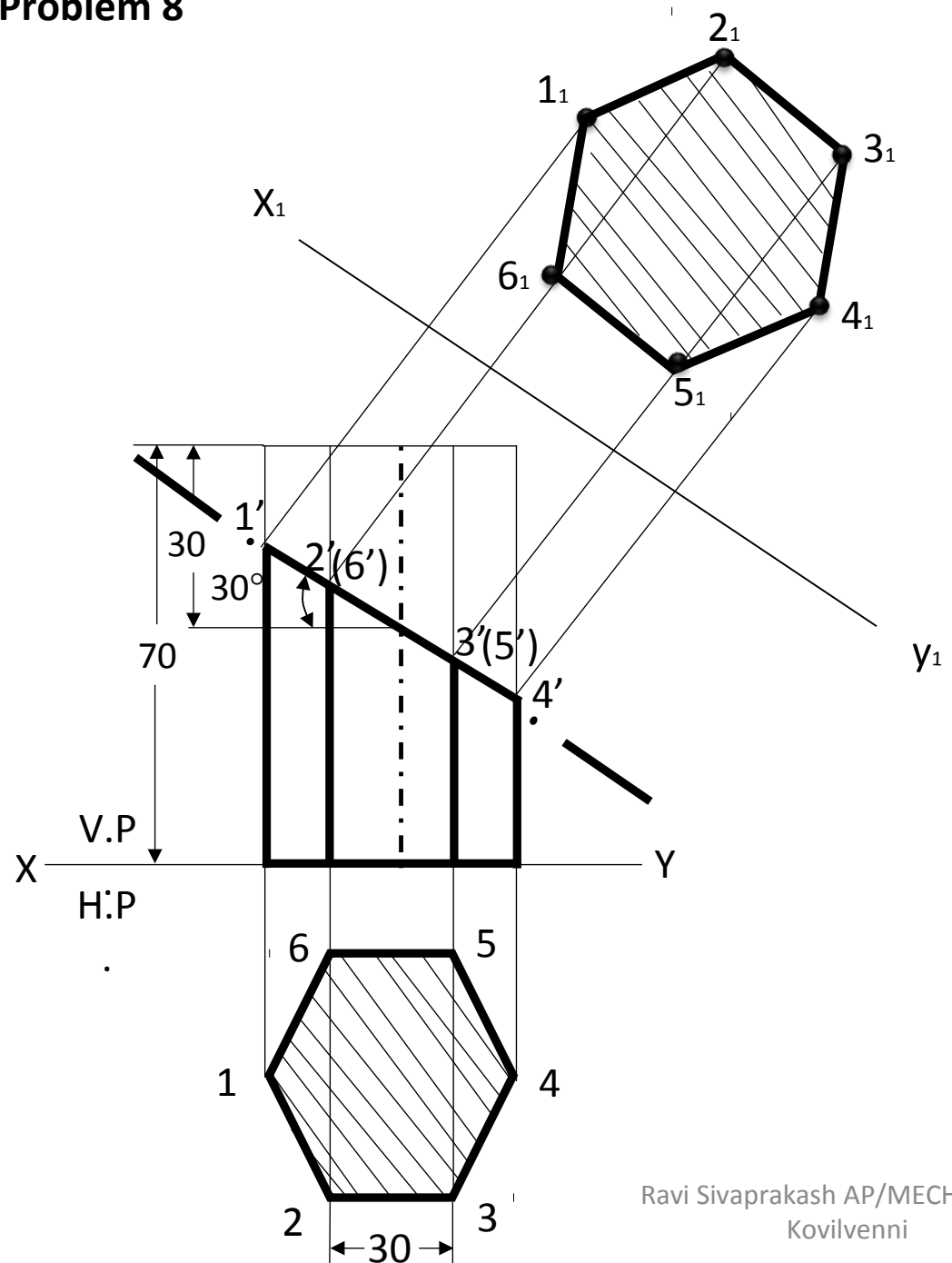
Problem 7

A **hollow square prism** of base side 50 mm (outside), thickness 10 mm and axis length 70 mm is resting on the HP on one of its ends with a vertical face making 45° with the VP. It is cut by a plane perpendicular to the VP and inclined at **30° to the HP**. The cutting plane meets the axis at 17 mm from the top. Draw the front view, sectional top view and true shape of the section. Page no 258

Problem 8

A **hexagonal prism** of base side 30 mm and axis length 70 mm rests on one of its ends on the HP with **two base sides parallel to the VP**. It is cut by a plane perpendicular to the VP and inclined at **30° to the HP**. The cutting plane meets the axis at **30 mm from the top**. Draw the front view, sectional top view and the true shape of the section.

Problem 8



- The distance of 1_1 from $X_1Y_1 = XY - 1$
- The distance of 2_1 from $X_1Y_1 = XY - 2$
- The distance of 3_1 from $X_1Y_1 = XY - 3$
- The distance of 4_1 from $X_1Y_1 = XY - 4$
- The distance of 5_1 from $X_1Y_1 = XY - 5$
- The distance of 6_1 from $X_1Y_1 = XY - 6$

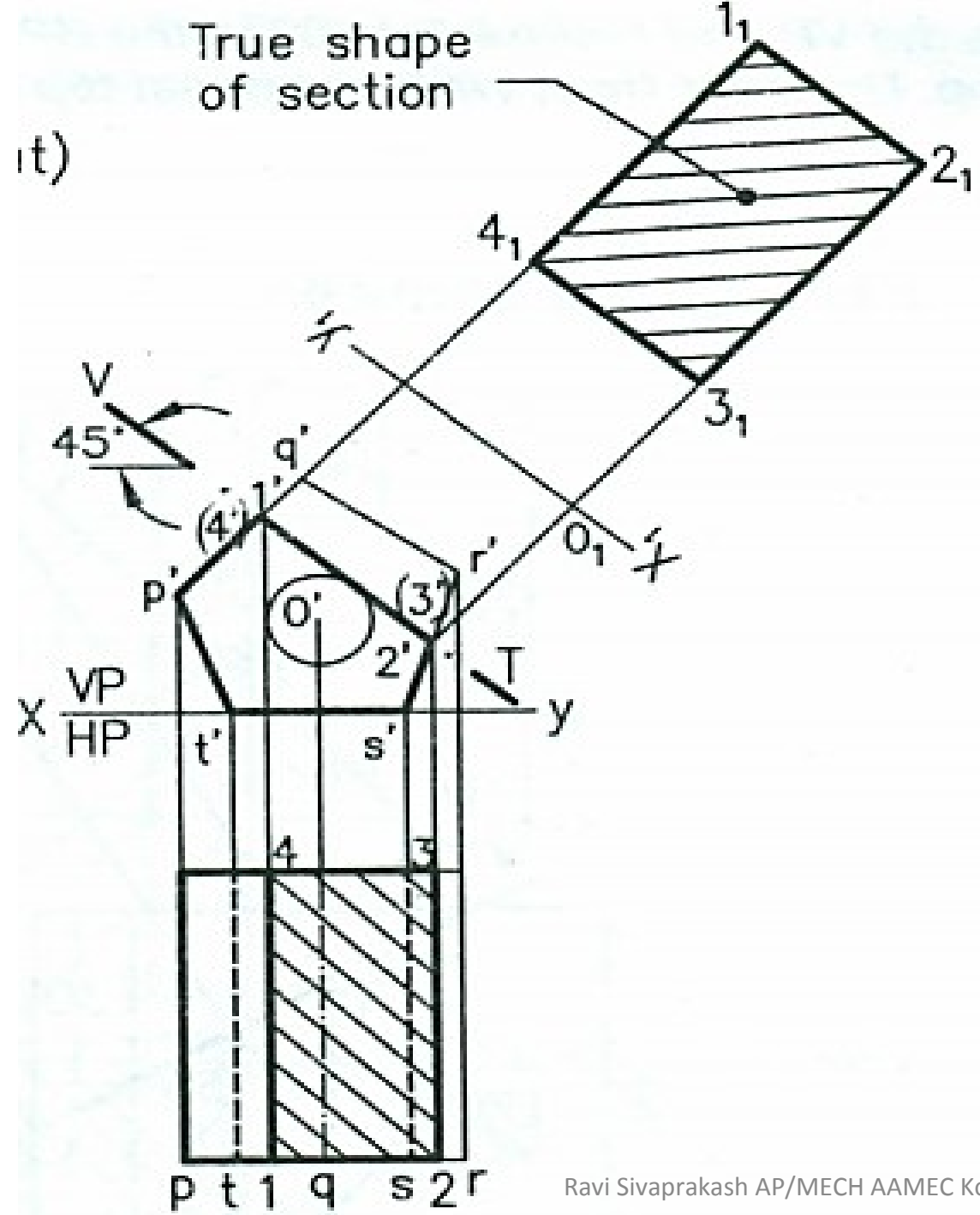
Problem 9

A **hexagonal prism** of base side 40 mm and height 100 mm rests on the HP on one of its ends with two rectangular faces parallel to the VP. It is cut by a plane perpendicular to the VP and inclined at **45° to the HP**. The cutting plane meets the axis at 30 mm from the top. Draw the front view, sectional top view and the true shape of the section. page no 253

Problem 10

A **pentagonal prism** of base side 30 mm and length 70 mm is lying on the HP on one of its rectangular faces with its axis perpendicular to the VP. It is cut by a plane perpendicular to the VP and inclined at **45° to the HP**. The shortest distance between the axis and the cutting plane is 10 mm. Draw the front view, sectional top view and the true shape of the section. Page no 251

Problem 10



Problem 11

A **pentagonal prism** of base side 30 mm and axis length 75 mm rests on the HP on one of its ends with a rectangular face parallel to the VP. It is cut by a plane perpendicular to the VP and inclined at **30° to the HP** and meeting the axis at 25 mm from the top. Draw the front view, sectional top view and the true shape of the section. Page no 290

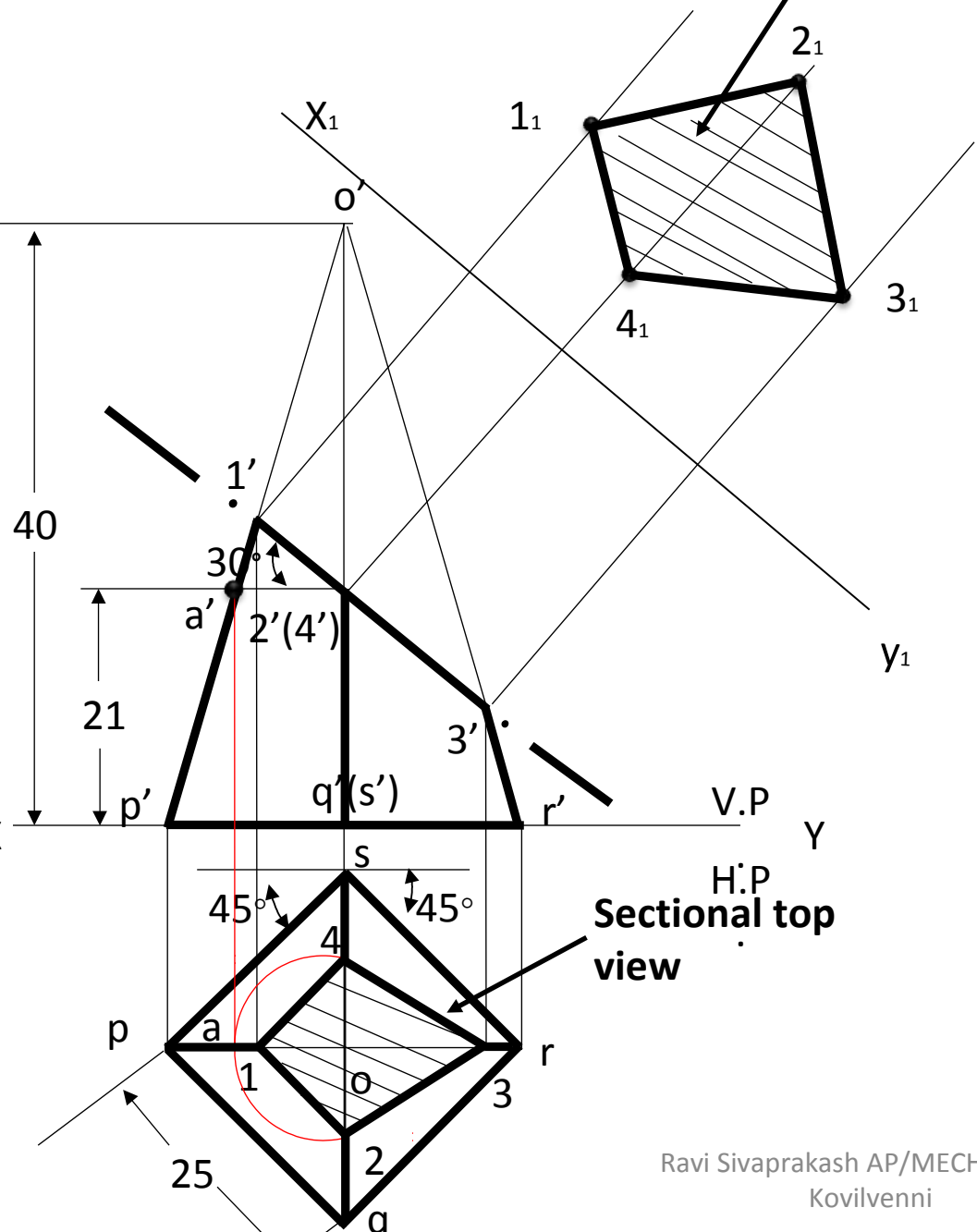
Problem 12

A **Square pyramid** of base side 25 mm and altitude 40 mm rests on the HP on its base with the base edges equally inclined to the VP. It is cut by a plane perpendicular to the VP and inclined at **30° to the HP** meeting the axis at 21 mm above the HP. Draw the sectional top view and the true shape of the section.

Problem 12

True shape of section

Faces equally inclined to the VP.



Points 2' and 4' cannot be projected directly. For this draw a line through 2' parallel to the base to meet o'p'.

With o as centre and "oa" as radius, draw arc to meet oq at 2 and os at 4.

- The distance of 1₁ from X₁Y₁ = XY-1
- The distance of 2₁ from X₁Y₁ = XY-2
- The distance of 3₁ from X₁Y₁ = XY-3
- The distance of 4₁ from X₁Y₁ = XY-4

Sectional top view

Problem 13

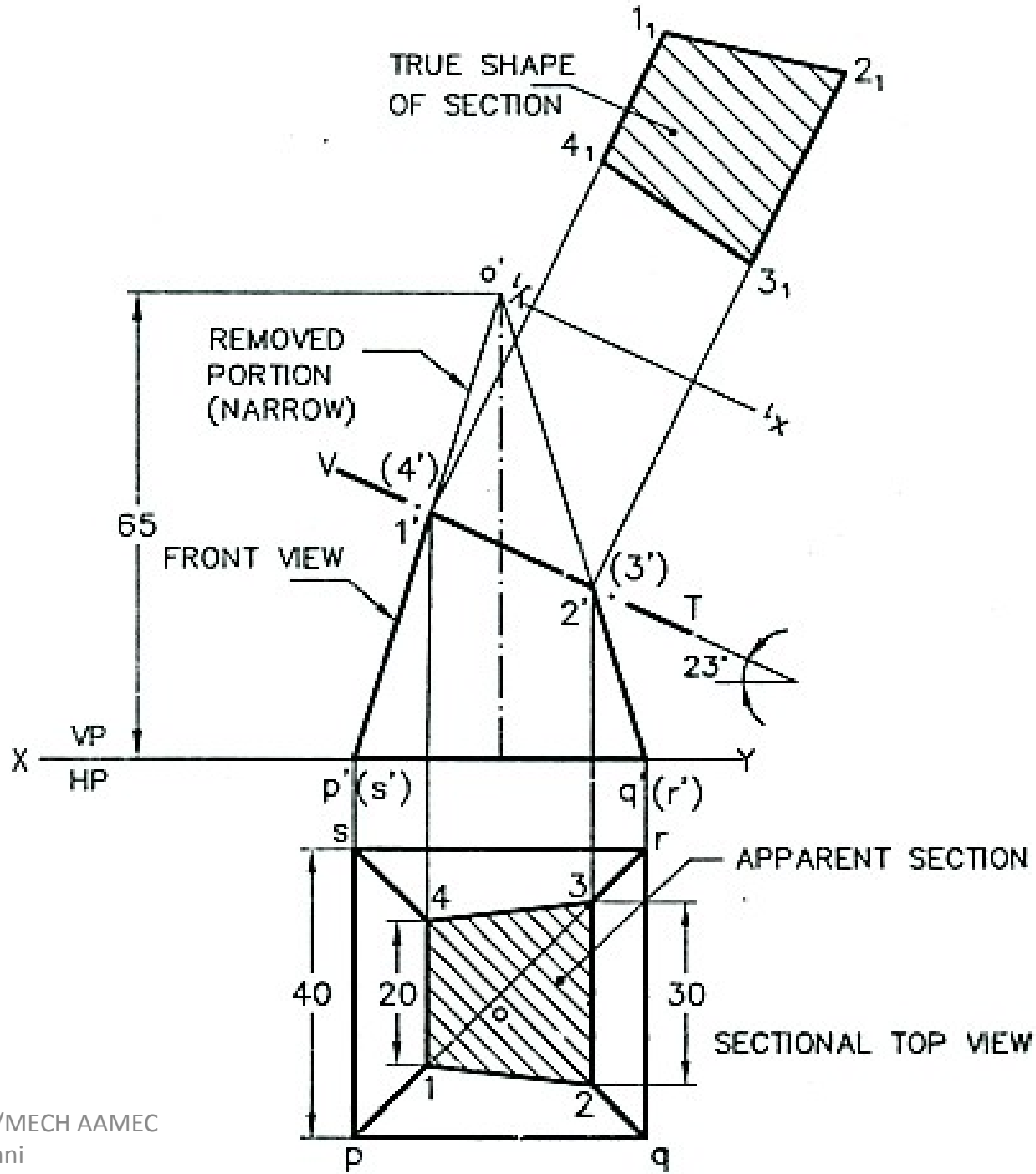
A **Square pyramid** of base side 30 mm and axis 60 mm long is standing on HP with its base edges equally inclined to VP. It is cut by a section plane perpendicular to VP and inclined at 30° **to HP, bisecting the axis**. Draw the sectional top view and the true shape of the section, if the upper portion is removed.

Page no 14.15

Problem 14

A **square pyramid** of base side 40 mm and axis 65 mm rests on its base on HP. A cutting plane inclined to HP and perpendicular to VP cuts the pyramid in such a way that the **true shape** of the section is a **trapezium** of parallel sides measuring 30 mm and 20 mm. Draw its sectional top view and the true shape of the section. Also find the inclination of the cutting plane to the HP. Page no 267

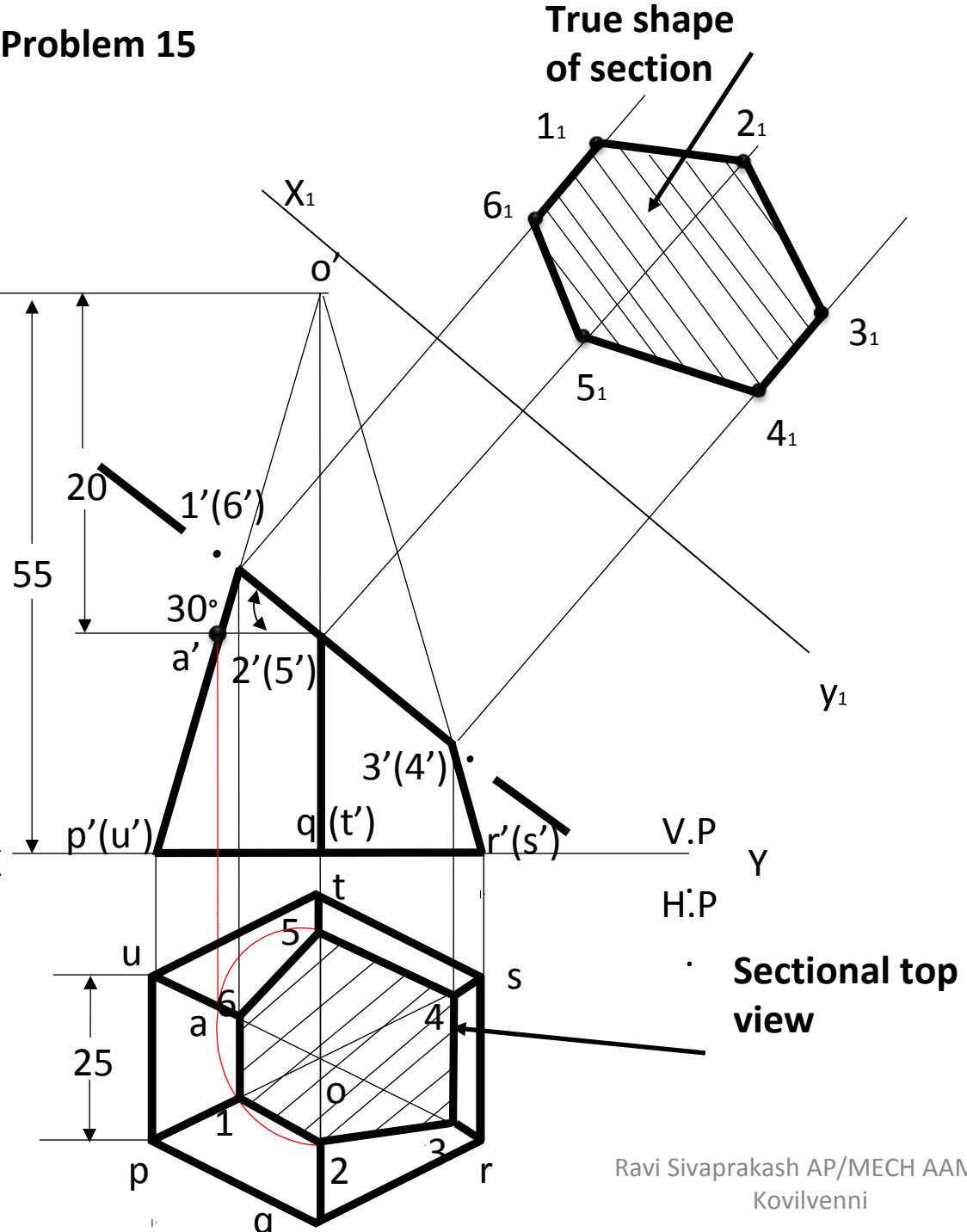
Problem 14



Problem 15

A **hexagonal pyramid** of base side 25 mm and axis 55 mm 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 20 mm from the vertex. Draw the front view, sectional top view and the true shape of the section.

Problem 15



Points 2' and 5' cannot be projected directly. For this draw a line through 2' parallel to the base to meet o'p'.

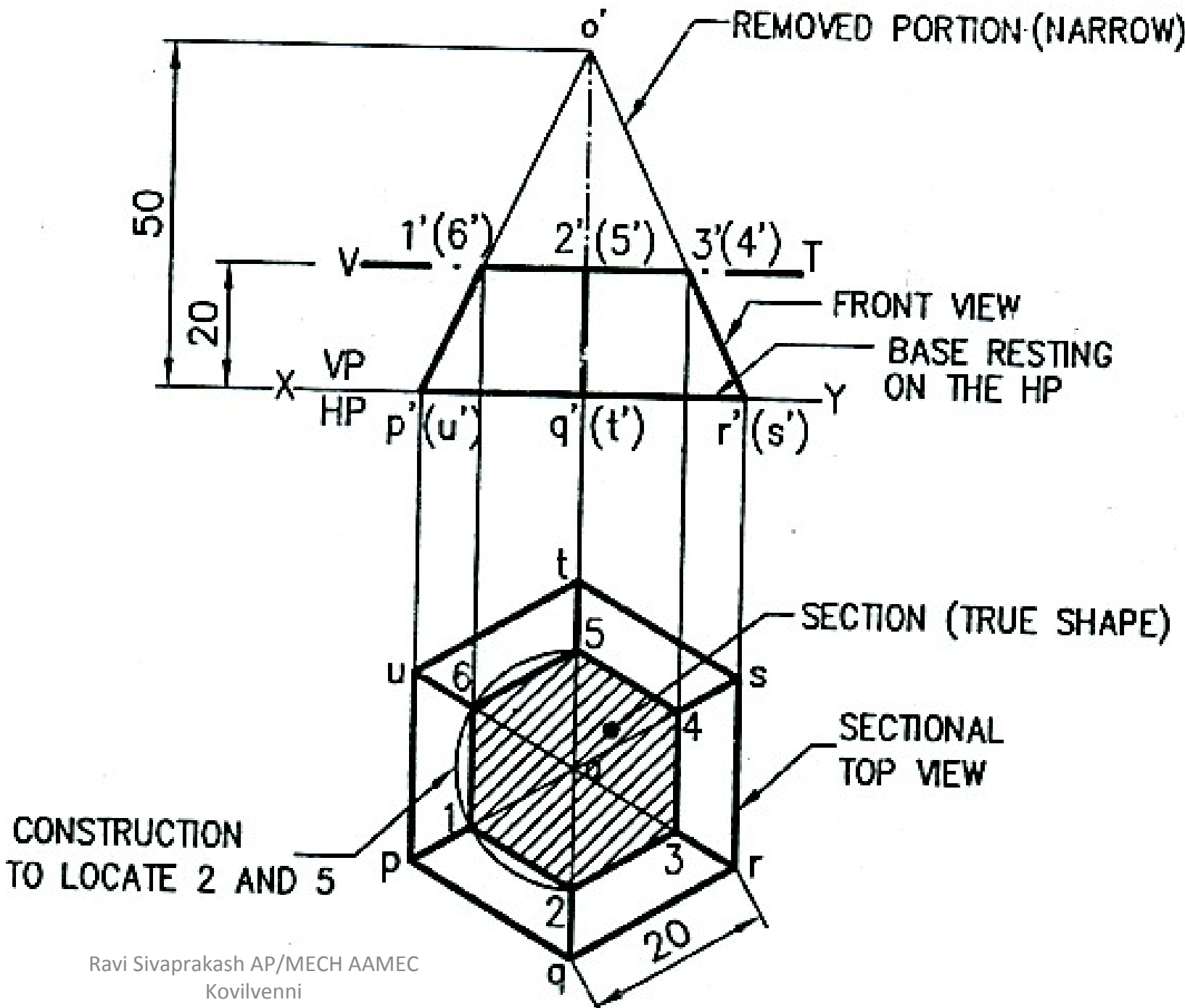
With o as centre and "oa" as radius, draw arc to meet oq at 2 and os at 5.

- The distance of 1₁ from X₁Y₁ = XY-1
- The distance of 2₁ from X₁Y₁ = XY-2
- The distance of 3₁ from X₁Y₁ = XY-3
- The distance of 4₁ from X₁Y₁ = XY-4
- The distance of 5₁ from X₁Y₁ = XY-5
- The distance of 6₁ from X₁Y₁ = XY-6

Problem 16

A **hexagonal pyramid** of base side 20 mm and altitude 50 mm rests on its base on the HP with two edges of the base perpendicular to the VP. A cutting plane **parallel to the HP** cuts the pyramid at a height of **20 mm above** the base. Draw the front view and the sectional top view. Page no 259

Problem 16



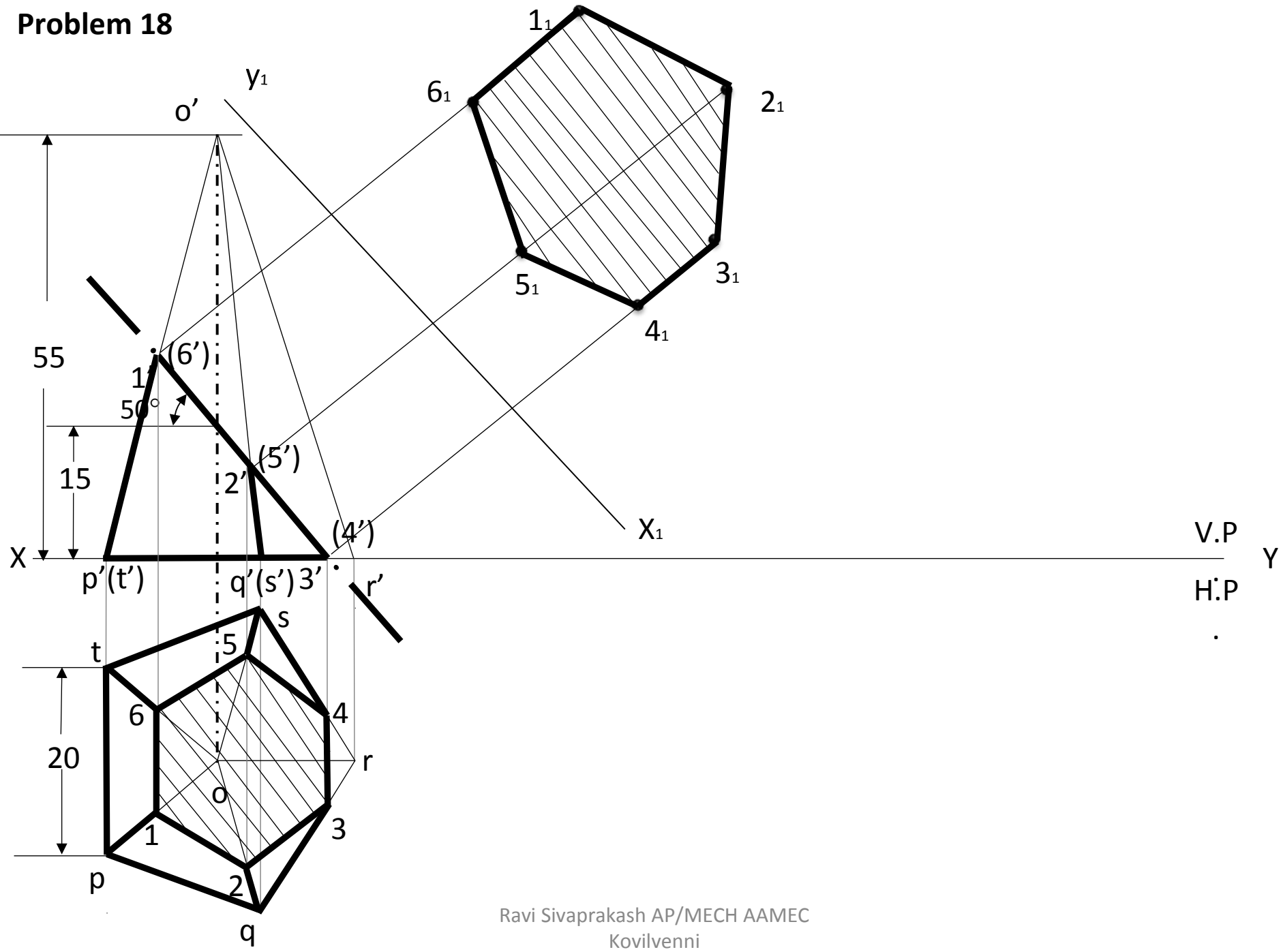
Problem 17

A **hexagonal pyramid** side of base 30 mm and height 65 mm is resting on its base on HP with two edges parallel to VP. It is cut by a plane perpendicular to VP, inclined at **45° to HP** and intersecting the axis at a point 25 mm above the base. Draw the sectional top view and true shape of section. Page no 14.13

Problem 18

A **pentagonal pyramid** of base side 20 mm and altitude 55 mm rests on its base on the HP with one of the base edges perpendicular to the VP. It is cut by a plane inclined at **50° to the base**. The cutting plane meets the axis at 15 mm above the base. Draw the front view, sectional top view and the true shape of the section.

Problem 18



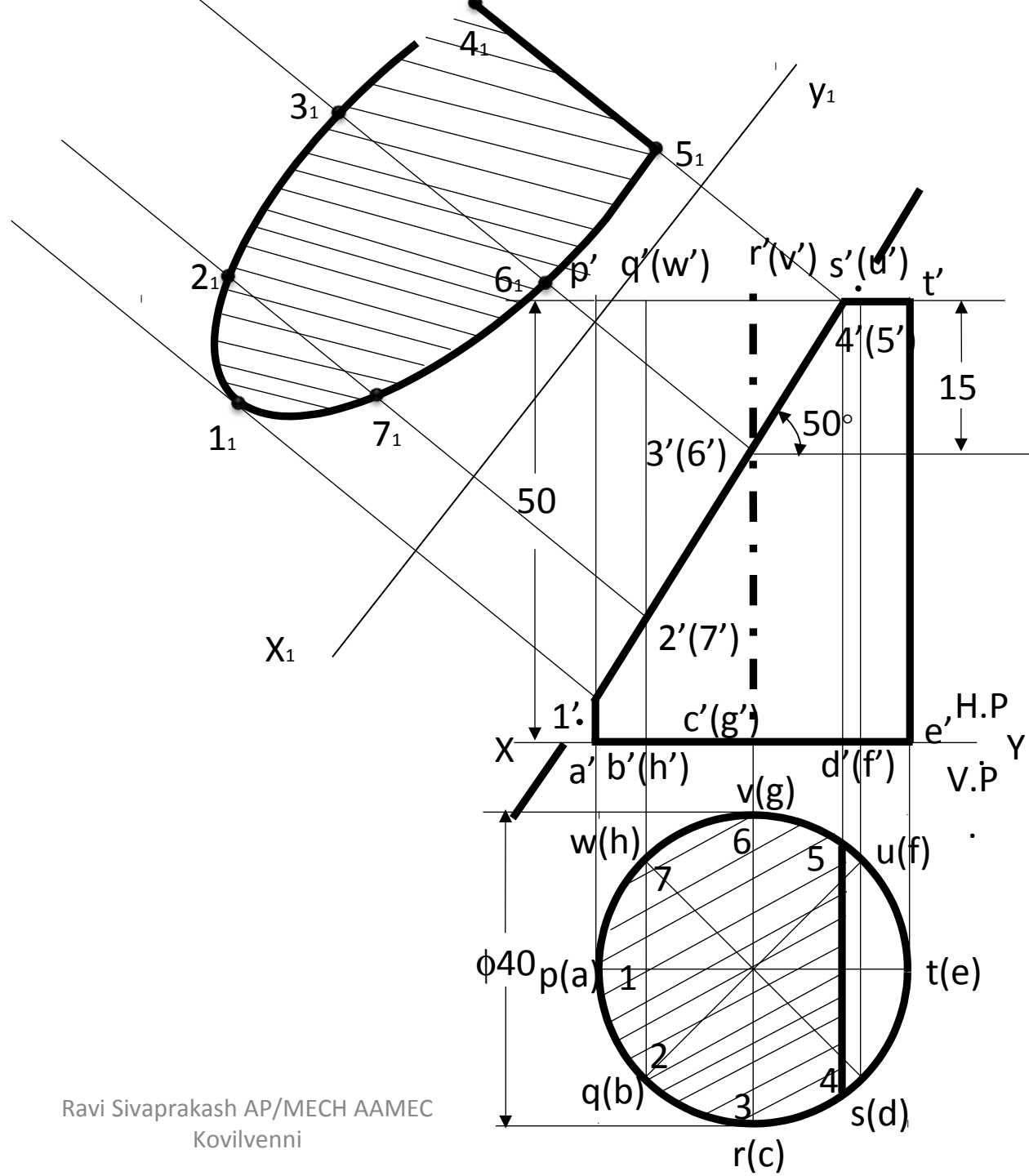
Problem 18A

A **Pentagonal pyramid** of base side 40 mm and height 80 mm rests on the base such that one base edge is perpendicular to VP. It is cut by a section plane inclined at **45° to HP** and passing through the mid-point of the **axis removing the apex**. Draw the front view, sectional top view and true shape of the section. (Univ Qstn)

Problem 19

A **cylinder** of diameter 40 mm and height 50 mm rests on its base on the HP. It is cut by a plane perpendicular to the VP and inclined at **50° to the HP**. The cutting plane meets the axis at a distance of **15 mm from the top**. Draw the front view, sectional top view and the true shape of the section.

Problem 19



Problem 20

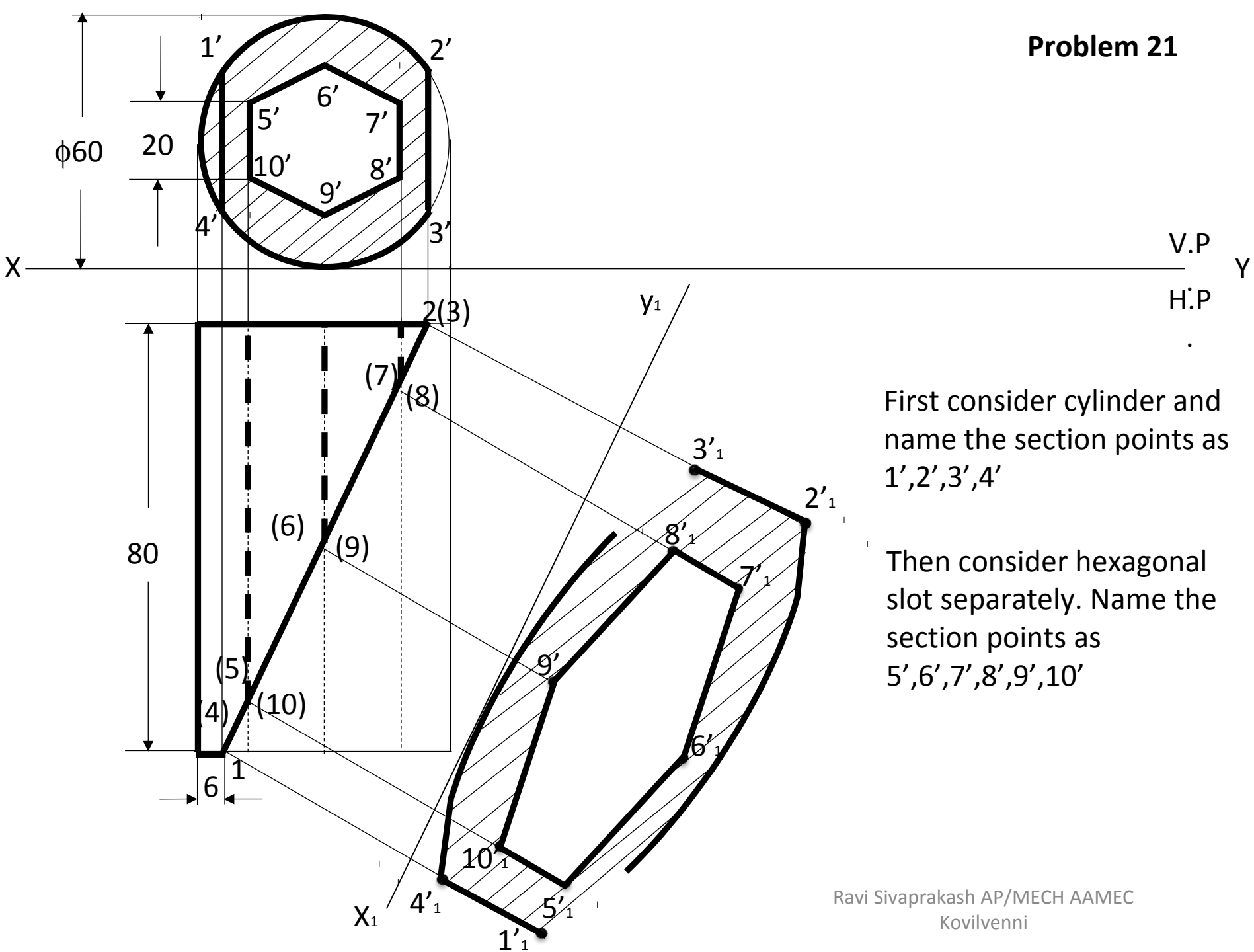
A **cylinder** of diameter 40 mm and height 60 mm is having its axis vertical. It is cut by a plane perpendicular to VP and inclined at **30° to HP**. The plane **bisects the axis** of the cylinder. Draw its front view, sectional top view, sectional side view and true shape of section.

Page no 14.20

Problem 21

A **cylinder** of diameter 60 mm and height 80 mm has a central **hexagonal slot** of side 20 mm running right through the length. The cylinder is lying on the HP with its axis perpendicular to the VP. A vertical cutting plane cuts the cylinder in such a way that it meets the bases at 6 mm from diametrically opposite ends. Draw the sectional front view and the true shape of the section.

Problem 21



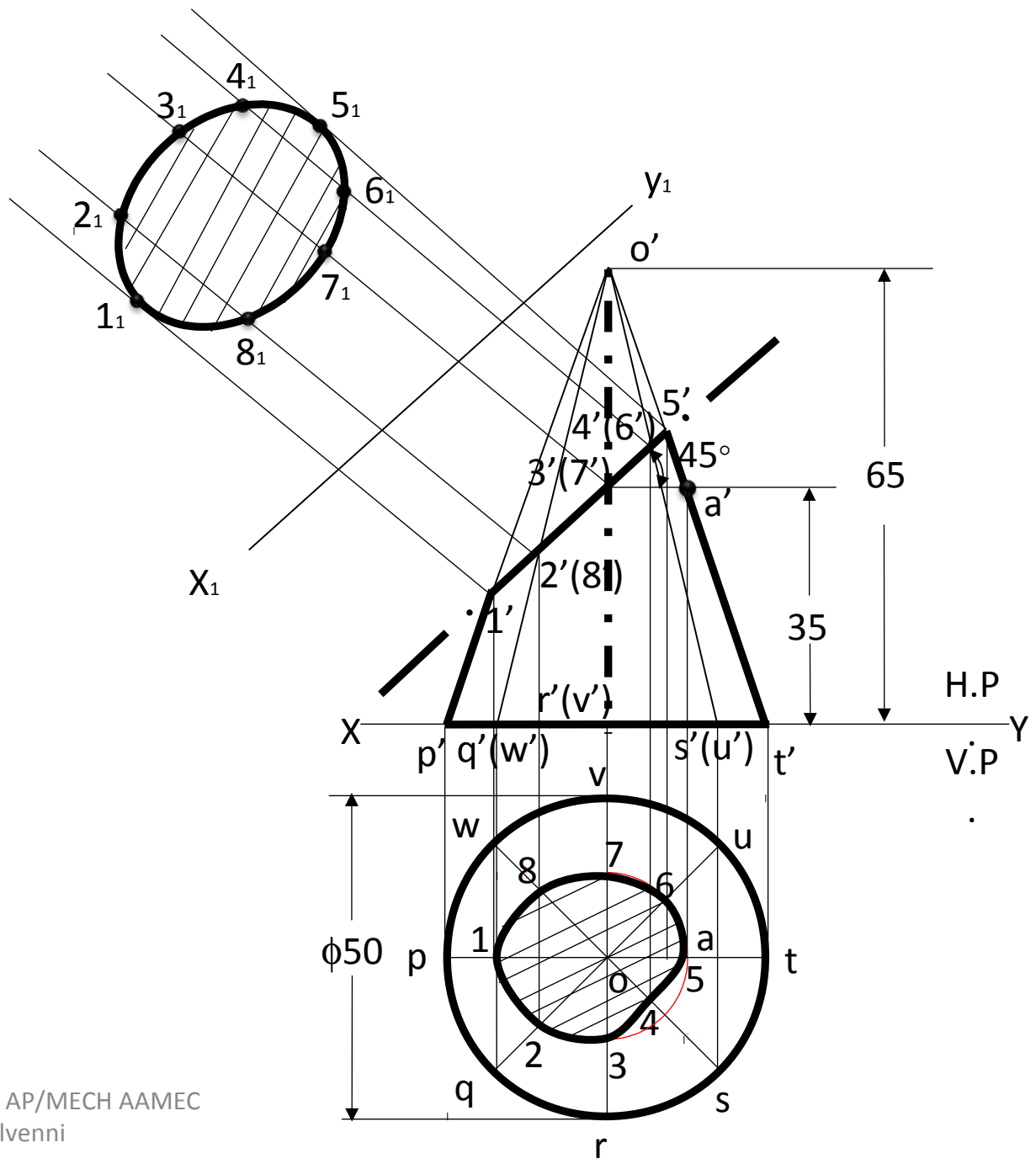
First consider cylinder and name the section points as 1',2',3',4'

Then consider hexagonal slot separately. Name the section points as 5',6',7',8',9',10'

Problem 22

A **cone** base 50 mm diameter and axis 65 mm long, rests with its base on the HP. It is cut by a section plane perpendicular to VP, inclined at **45° to HP** and passing through a point on the axis **35 mm above the base**. Draw the sectional top view and the true shape of the section.

Problem 22

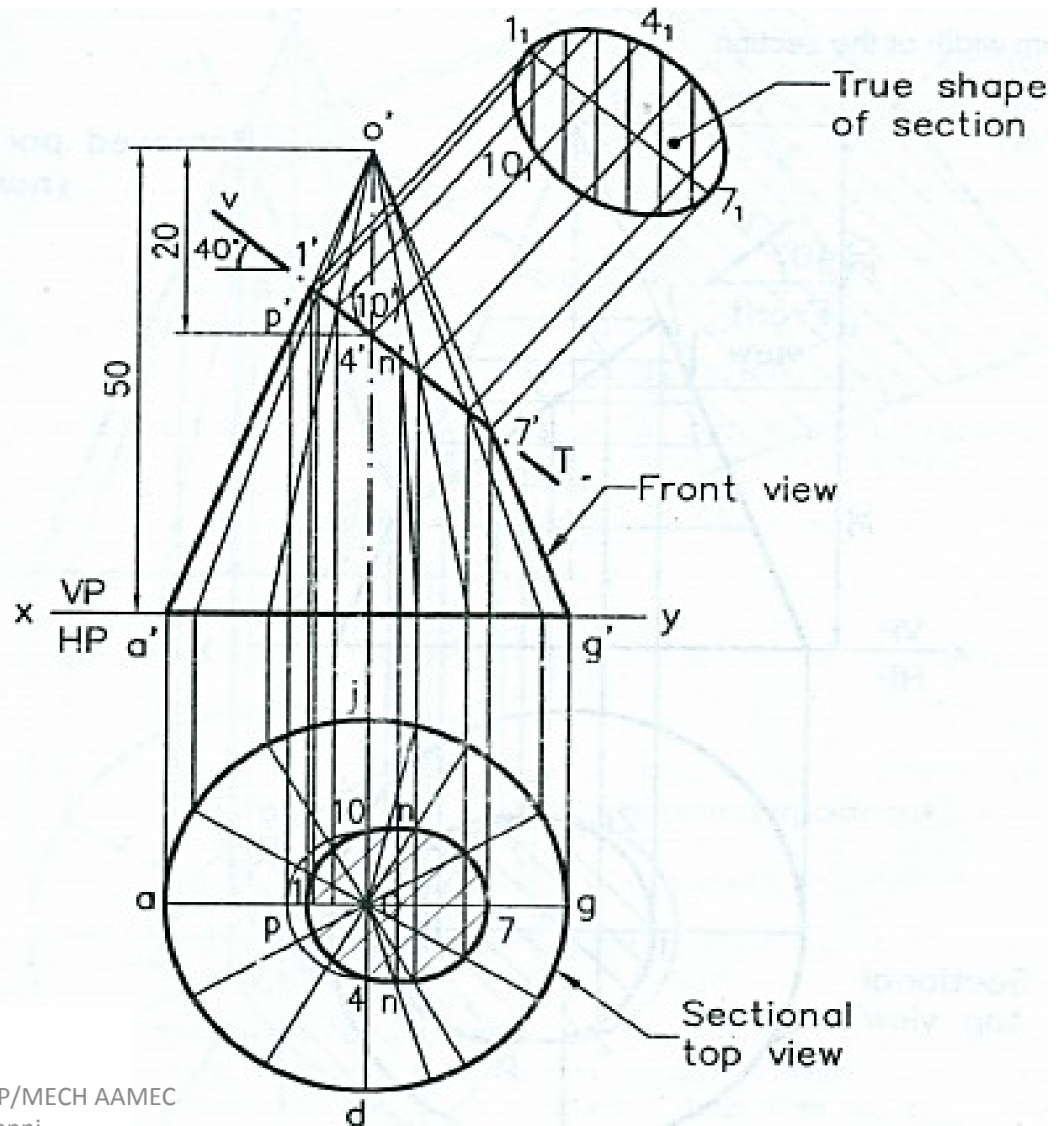


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Problem 23

A **cone** of base diameter 40 mm and height 50 mm rests on its base on the HP. It is cut by a plane perpendicular to the VP and inclined at **40° to HP**. The cutting plane meets the axis at **20 mm from the vertex**. Draw the sectional top view and the true shape of the section. Page no 280

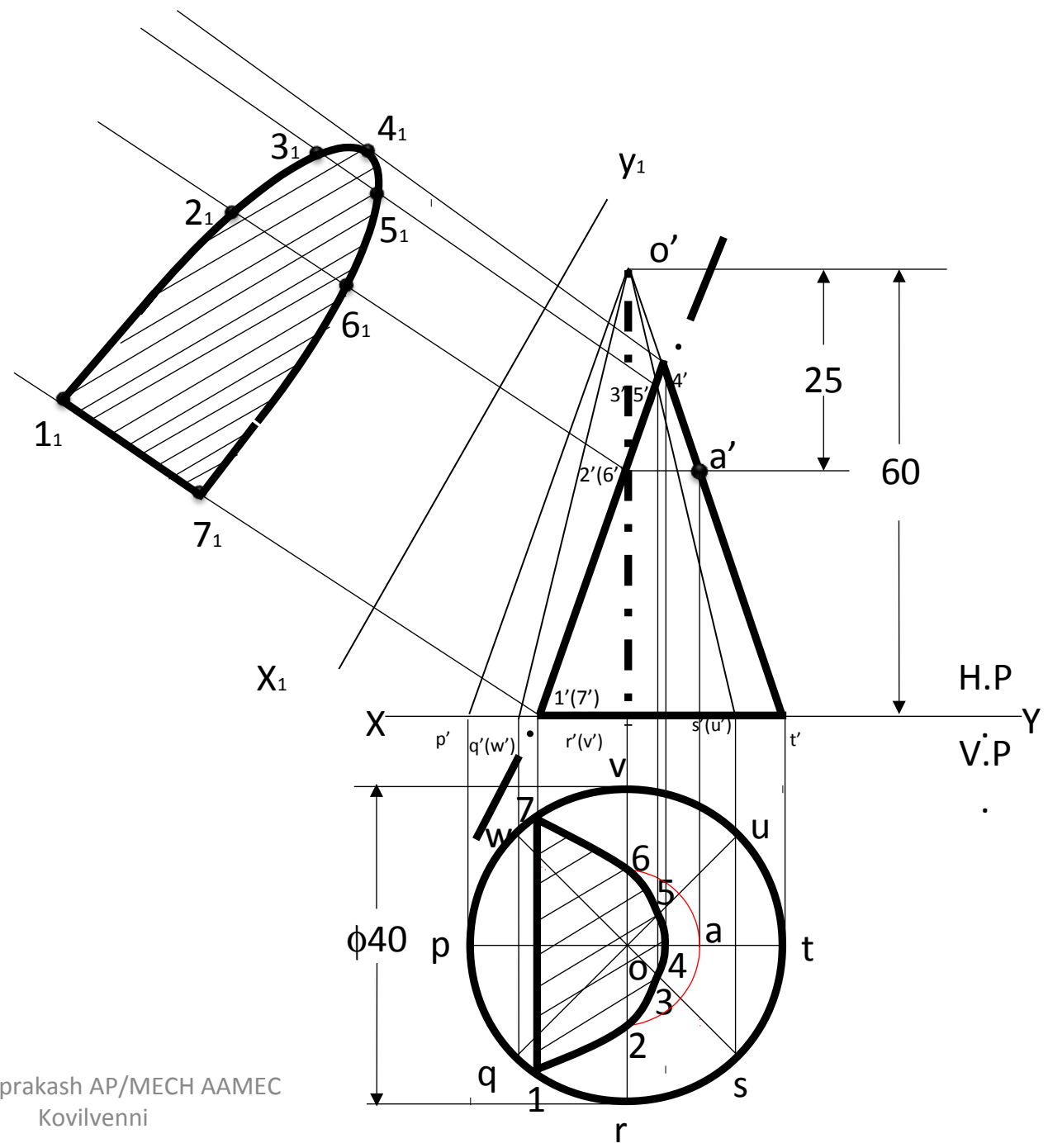
Problem 23



Problem 24

A **cone**, base 40 mm diameter and axis 60 mm long, rests with its base on HP. It is cut by a section plane perpendicular to VP, **parallel to** one of the end **generators** and passing through a point on the axis **25 mm from the apex**. Draw the sectional top view and the true shape of the section.

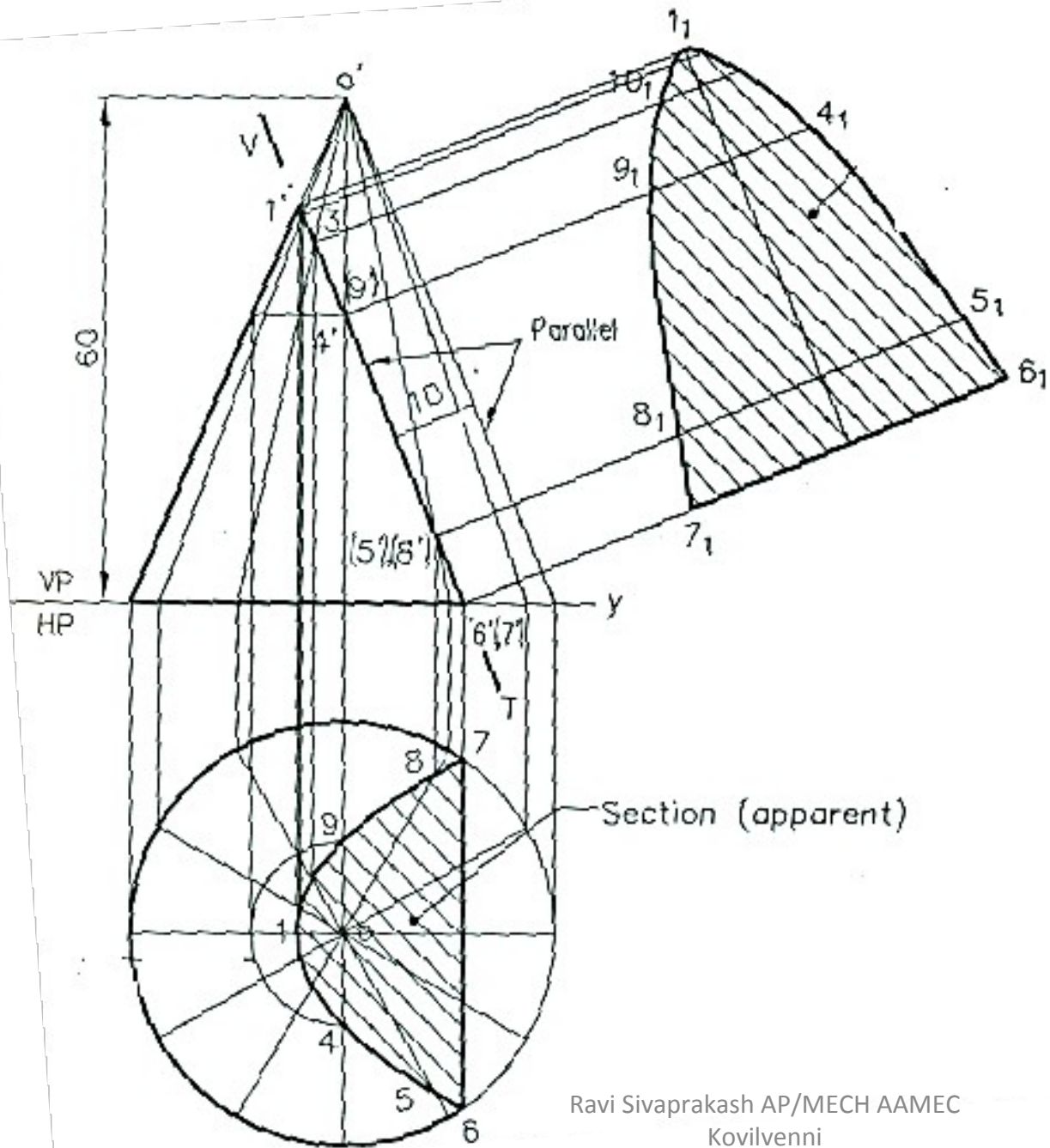
Problem 24



Problem 25

A cone of base diameter 50 mm and altitude 60 mm rests on its base on the HP. It is cut by a plane perpendicular to the VP and parallel to one of the extreme generators, 10 mm away from it. Draw the sectional top view and the true shape of the section. Page no 282

Problem 25



Problem 26

A **cone of** base diameter 40 mm and altitude 50 mm rests on its base on the HP. It is cut by a section plane perpendicular to the VP and inclined at **80° to the HP**, passing **through the apex**. Draw the sectional top view and the true shape of the section. Page no 285

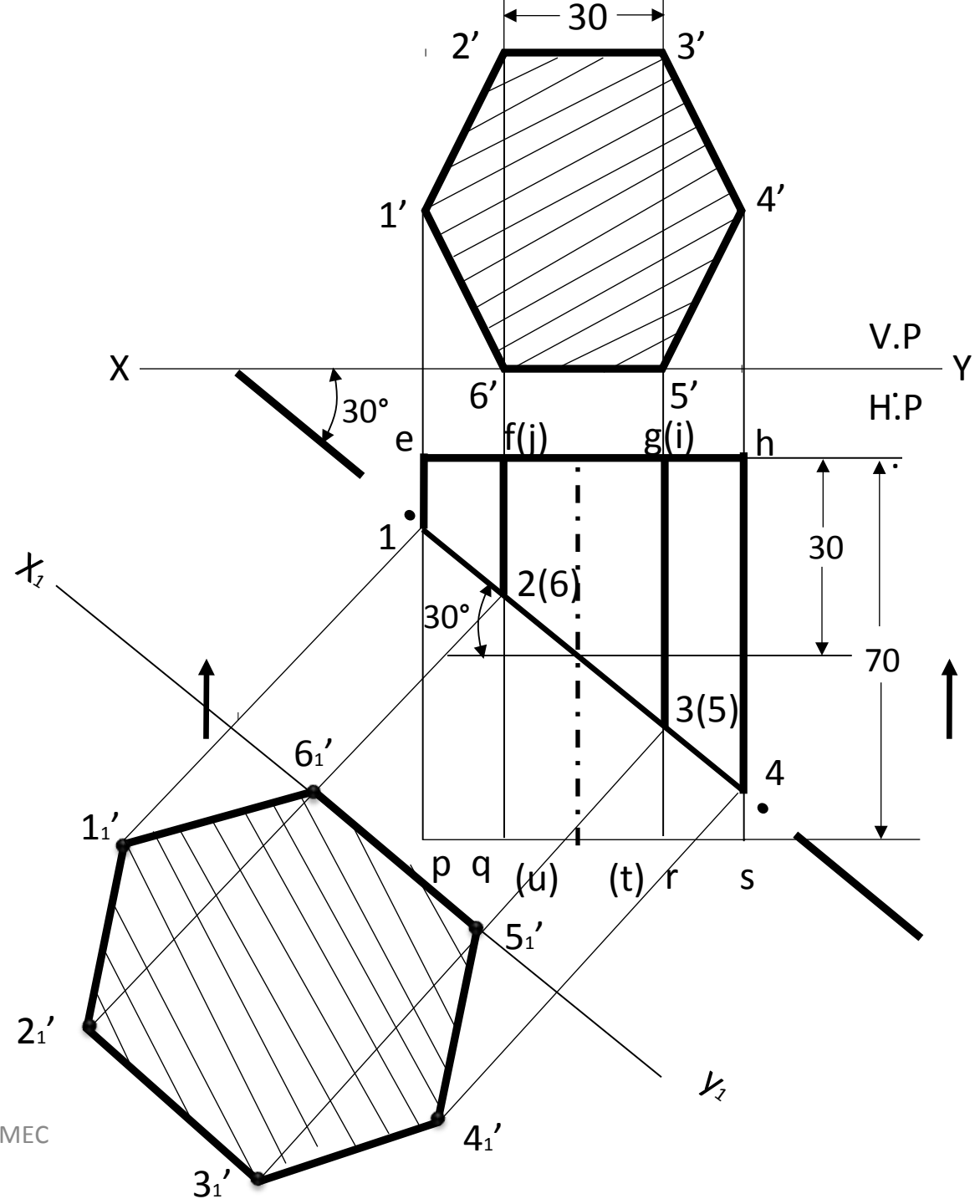
Problem 27

A **hexagonal prism** of base side 30 mm and axis length 70 mm rests on the HP on one of its rectangular faces with its axis perpendicular to the VP. It is cut by a vertical plane inclined at **30° to the VP**. The cutting plane meets the axis at a distance of 30 mm from one end. Draw the top view, sectional front view and the true shape of the section.

Problem 27

$6_1' 2_1' = 6' 2'$

$5_1' 3_1' = 5' 3'$



Problem 28

A **cube** of side 25 mm rests on the HP on one of its faces with a vertical face inclined at 35° to the VP. A plane perpendicular to the HP and inclined at 50° to the VP cuts the cube, 3 mm away from the axis. Draw the top view and the sectional front view. Also draw the true shape of the section.

Problem 28

