Unit-1
## Plane Curves and Free Hand Sketching

1. A circle of 50 mm diameter rolls along a line. A point on the circumference of the circle is in contact with the line in the beginning and after one complete revolution. Draw the cycloidal path of the point. Draw a tangent and normal at any point on the curve. *[Jan'09]*

2. Draw the locus of a curve traced by a point, when the distance of focus from the directrix is equal to 35mm and eccentricity is 4/3. Also draw the tangent and normal to the curve at any point on the curve.

3. Draw the conic curve, if the distance of focus from the directrix is 70 mm and the eccentricity is 3/4. Also draw a tangent and a normal at any point on the curve *[Jan'09]*

4. Draw the involute of a circle of diameter 40 mm and draw the tangent and the normal to the involute at any point on the curve. *[Jan'09]*

5. Draw a hyperbola when the distance between its focus and directrix is 50 mm and eccentricity is 3/2. Also draw the tangent and normal at a point 25 mm from the directrix. *[Jan'10]*

6. The focus of a conic is 50 mm from the directrix. Draw the locus of a point 'P' moving in such a way that its distance from the directrix is equal to its distance from the focus. Name the curve. Draw a tangent to the curve at a point 60 mm from the directrix. *[Jan'10]*

7. A fixed point F is 3.5cm from a fixed straight line. Draw the locus of the point P moving in such a way that its distance from the fixed straight line is equal to its distance from F. Name the curve and draw a normal and tangent at any point on the curve *[June'11]*

8. Draw the involute of a circle of diameter 50mm when a string is unwound in the clockwise direction. Draw a tangent and normal at a point located on the involute. *[Jan'12]*

9. Draw the locus of a point P which moves in a plane in such a way that the ratio of its distances from a fixed point F and a fixed _straight line AB is always 2/3. The distance between the fixed point F and fixed straight line is 50mm. Also draw a tangent and normal on a point on the locus at a horizontal distance of55 mm from the fixed straight line *[Jan'12]*

10. An inelastic string of length 150mm is wound around a circle of diameter 40 mm. draw the path traced by the end of the string. Draw also normal and tangent at any point on the curve.
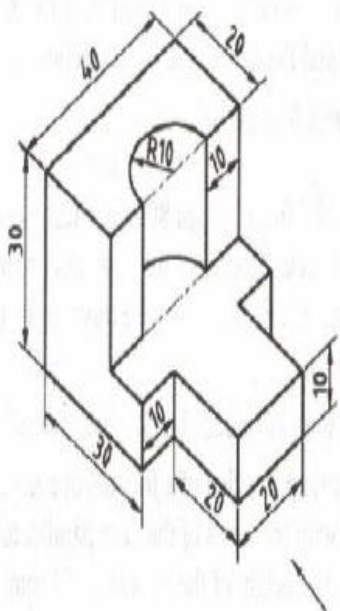
11. Construct a hyperbola when the distance between the focus and the directrix is 40mm and the eccentricity is 4/3. Draw a tangent and normal at any point on the hyperbola.

12. Make free hand sketches of the front, top and right side views of the object shown in Fig *[Nov'11]*
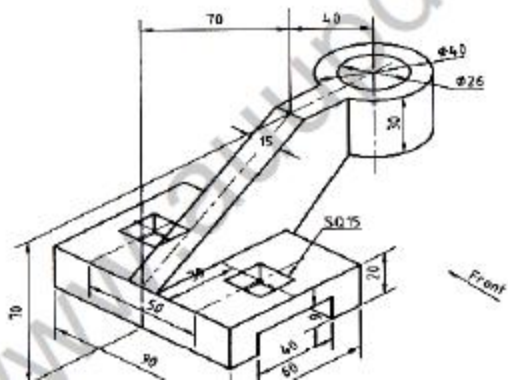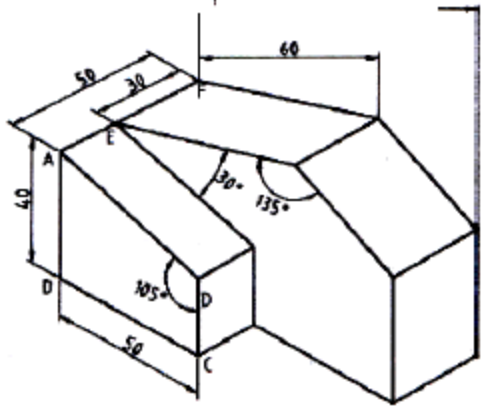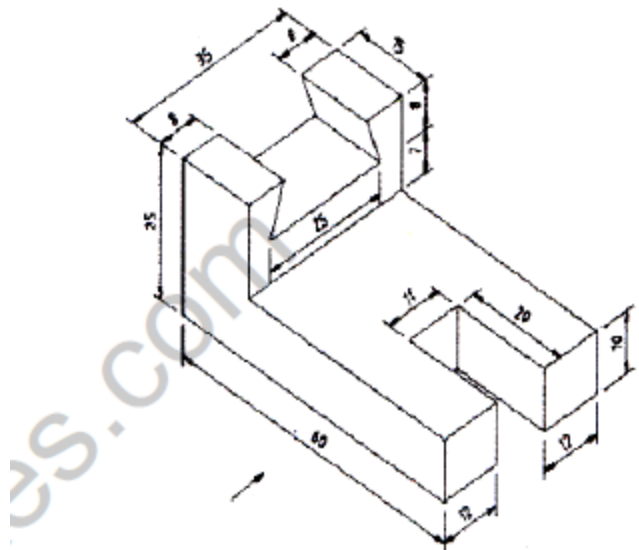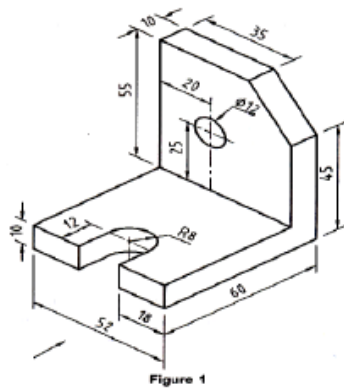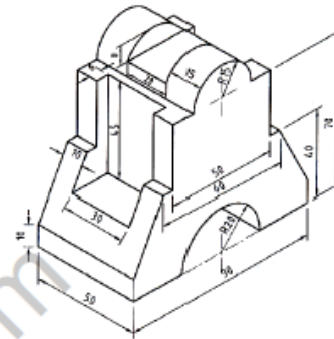
Figure 1

Figure 1

Projection of points

1. Draw the projections of the following points on a common reference line. A) P 35mm behind the VP and 20mm below the HP, B) Q 40mm in front the VP and 30mm above the HP. C) R 50mm behind the VP and 15mm above the HP. D) S 40mm below the HP and in the VP. E) T 30 mm in front of the VP and 50mm below the HP.**(Jan 2013)**

Projections of lines

2. A line PF, 65 mm has its end P, 15 mm above the HP and 15 mm in front of the VP. It is inclined at 55° to the HP and 35° to the VP. Draw its projections.**[June'09]**

3. The end A of a line AB is 35mm above HP and 30mm in front of VP. The line is inclined at 35° to HP. It's top view is 75mm long inclined at 40° to XY. Draw the projections of straight line. **[Jan'11]**

4. A line PQ has its end P, 10 mm above the HP and 20 mm in front of the VP, the end Q is 35 mm in front of the VP. The front view of the line measures 75 mm. The distance between the end projectors is 50 mm. Draw the projections of the line and find its true length and its true inclinations. with the VP and HP.**[Jan'10]**

5. A line AB 90 mm long is inclined at 45° to the HP and its top view makes an angle of 60° with the VP. The end A is in the HP and 12 mm in front of the VP. Draw its front view and find its true inclination with the VP.**[Nov'10]**

6. The end P of a line PQ is 30 mm above HP and 35 mm in front of VP. The line is inclined at 35° to the HP. Its top view is 70 m long and inclined at 40° to the XY. Draw the projections of the straight line. Locate the traces. Find the true length and inclination of the line with VP**. [June'11]**

7. A straight line AB has its end A, 20mm above HP and 25mm Infront of VP. The other end B is 60mm above HP and 65mm infront of VP. The distance between ends of the projectors is 60mm. find the true length and true inclinations of the line with HP and VP. Also mark traces.**[Jan'09]**

8. The plan of a line AB is 80mm long and makes 35° with XY. Its elevation makes 45° with XY and line intersects XY at A. find its true length and inclinations to HP and VP. .**[Jan'10]**

9. A line AB 60mm long has its end B, 20mm above HP and 25mm infront of VP. The end A

is 50mm away from the both reference planes. Draw its projections and find its inclinations with HP and VP. **[Jan'11]**

10. The front view of a line AB 90mm long is inclined at 45° to XY line. The front view measures 65mm long. Point A is located 15 mm above HP and is in VP. Draw the projections. **[Jan'12]**

11. The top view of a 75mm long line AB measures 65mm while the length of its front view is 50mm. its one end A is in HP and 12mm in front of the VP. Draw the projections. **[Jan'13]**

12. The end P of a line PQ, 70mm long is 15mm above HP and 20mm infront of the VP. Its plan is inclined at 45° to the VP. Draw the projections. **[Jan'13]**

13. A line CD, inclined at 25° to the HP, measures 80 mm in top view. The end C is in the first quadrant and 25 mm and 15 mm from the HP and the VP respectively. The end D is at equal distances from both the reference planes. Draw the projections, find true length and true inclinations with the VP .**[Jan'09]**

14. The projection of a line measures 80 mm in the top view and 70 mm in the front view. The midpoint of the line is 45 mm in front of VP and 35 mm above HP. One end is 10 mm in front of VP and nearer to it. The other end is nearer to HP. Draw the projections

mm in front of VP and nearer to it. The other end is nearer to HP. Draw the projections of the line. Find the true length and true inclinations.**[Jan'10]**

15. A straight line ST has its end S, 10 mm in front of the VP and nearer to it. The midpoint m of the line is 50 mm in front of the VP and 40 mm above HP. The front and top view measure 90 mm and 120 mm respectively. Draw the projections of the line. Also find its true length and true inclinations with the HP and the VP **[Jan'09]**

Projections of Planes

16. A regular pentagon of 30 mm side is resting on one of its edges on HP which is inclined at 45° to VP. Its surface is inclined at 30° to HP. Draw its projections*. [Jan'09]*

17. A regular pentagonal lamina ABCDE of side 30 mm has one of its edges parallel to the VP and inclined at 30° to the HP. The pentagon is inclined at 45° to the VP. Draw the projections. *[Jan'09]*

18. A rectangular plate of side 50mm x 25mm is resting on its shorter side on HP and inclined at 30° to VP. Its surface is inclined at 60° to HP. Draw its projections. *[Jan'12]*

19. A hexagonal lamina of side 30mm rests on one of its edges on HP. This edge is parallel to VP. The surface of the lamina is inclined 60° to HP. Draw its projections. *[Jan'12]*

20. A square lamina PQRS of side 40 mm rests on the ground on its corner P in such a way that the diagonal PR is inclined at 45° to the HP and apparently inclined at 30° to the VP. Draw its projections. *[June'11]*

21. A rectangular plate 70mm x 40 mm has one of its shorter edges in the VP inclined at 40° to the HP. Draw its top view, if its front view is a square of side 40 mm.*[Nov'10]*

22. A pentagon of side 30 mm rests on the ground on one of its comers with the sides containing the comer being equally inclined to the ground. The side opposite to the comer on which it rests is inclined at 30° to the VP and is parallel to the HP. The surface of the pentagon makes 50° with the ground. Draw the top and front views of the pentagon.*[June'09]*

23. A circular plate of diameter 60mm has the end P of the diameter PQ in the HP and the plate is inclined at 45° to the HP. Draw its projections when the diameter PQ appears to be inclined at 60° to the VP in the top view. *[Jan'09]*

Unit-3
Projection of Solids

1. A right pentagonal pyramid side of base 30mm and height 60mm rests on one of its base on HP, the base being lifted up until highest corner in it is 40mm above the HP. Draw the projection when the edge on which it rests made perpendicular to VP.

2. A cylinder of base diameter 60mm and height 80mm is resting on HP in one of its generators with its axis inclined at 500 to VP. Draw the projections.

3. A cone of 30mm diameter and 70mm height rests on the ground on one of its base circle point such that the apex is 20mm and the nearest base circle point is 50mm in front of VP and the base is perpendicular to HP. Draw the projections.

4. Draw the projections of a square prism of size 30mm 60mm with a solid diagonal vertical.

5. A hexagonal pyramid of base side 30mm and axis length 60mm is resting on HP o one of its base corners with the base sides containing the corner equally inclined to HP and its axis is parallel to both HP and VP. Draw its projections.

6. Draw the projections of a cylinder of diameter 30mm and axis 50mm long lies on HP on one of its generators and the base is perpendicular to HP and inclined at 600 to VP.

7. A cone of 15mm radius and 70mm height rests on the ground on one of its base circle points such that the apex is 20mm and the nearest base circle point is 50mm in front of VP and the base is perpendicular to HP. Draw the projections.

8. A right pentagonal pyramid of base side 20mm and altitude 60mm rests on one of its edges of the base in HP, the base being tilted up until the highest corner in it is 30mm above HP. Draw the elevation of the pyramid when the edge on which it rests is made perpendicular to VP.

9. A cylinder of diameter 40mm, height 60mm is resting on the ground on its base. It is then tilted such that a solid diagonal is vertical. Draw the projection.

10. Draw the projection of a hexagonal prism whose one rectangular face size is 25mm 65mm resting on HP on one of its base corners such that the other extreme corner is 30mm above HP with the axis parallel to VP.

11. A cone of diameter 40mm and height 60mm is freely suspended from one of its base points such that the axis parallel to VP. Draw the projection.

12. A hexagonal pyramid of base 25mm and axis 60mm long is freely suspended from corner of the base. Draw the projections.

13. Draw the projection of a cone of diameter 35mm and height 75mm lying on the ground on one of its base points with a generator perpendicular to H.P.

14. A hexagonal prism of side of base 25mm and axis 60mm long, freely suspended from a corner of the base. Draw the projections by change position method.

15. A cylinder, diameter of base 60mm and height 70mm, having a point of its periphery of base on HP with axis of the cylinder inclined to HP at 45o and parallel to VP. Draw the

projections of the cylinder.

16. Draw the projections of a pentagonal prism of 30mm base edges and axis 60mm long when the axis is inclined at 750 to the HP and parallel to the VP with an edge of the base on the HP.

17. A right regular hexagonal pyramid, edge of base 25mm and height 50mm, rests on one of its base edges on HP with its axis parallel to VP. Draw the projections of the pyramid when its base makes an angle 450 to the HP.

18. A hexagonal prism side of base 25mm and axis 60mm long, lies with one of its rectangular faces on the HP, such that the axis is inclined at 450 to the VP. Draw its projections.

19. A pentagonal prism, side of base 25mm and axis 50mm long, rests with one of its shorter edges on HP such that the base containing the edge makes an angle of 300 to HP and its axis parallel to VP. Draw its projections.

20. Draw the projections of a hexagonal prism of base side 20mm and axis length 50mm when its rests on the ground on one of the edges of the base and axis inclined at 350 to ground and parallel to the VP.

21. A square pyramid of base side 30mm and height 50mm rests on the ground on one of its base edges such that its axis is inclined at 450 to the ground and parallel to VP. Draw its projections.

22. A hexagonal prism of the base side 25mm and axis height 55mm resting on HP with one of its base edges such that, the axis is inclined at 300 to HP and parallel to VP. Draw the projections of Prism by using change of reference line method.

23. A pentagonal pyramid of base side 25mm and axis 55mm long lies with one of its slant edges on HP such that its axis is parallel to VP. Draw its projections.

24. A hexagonal prism side of base 25mm and axis 55mm long, lies with one of its rectangular faces on the HP, such that the axis is inclined at 550 to the VP. Draw its projections by using change of reference line method.

Unit-4

Sections of Solids

25. A cone of base diameter 70mm and height 80mm is resting on HP on its base. It is cut by a plane perpendicular to VP and parallel to a contour generator and is 10mm away from it. Draw the front view, sectional top view and true shape of the section.

26. A pentagonal prism of base edge 35mm and axis 65mm lies on HP with its base edge parallel to VP. It is cut by the plane perpendicular to HP and inclined at 30_0 to VP passes through a point 8mm away from the axis. Draw the sectional elevation and true shape of the section.

27. A cone of base diameter 50 mm and axis length 60 mm is resting on HP on its base. It is cut by a plane perpendicular to VP and inclined at 75° to HP and is passing through the apex of the cone. Draw its front view, sectional top view and true shape of section.

28. A pentagonal pyramid of base side 30 .nm and axis length 60 mm is resting on HP on its

base with a side of base parallel to VP. It is cut by a plane inclined at 45° to VP and perpendicular to HP and is 12 mm away from the axis. Draw its top view, sectional front view and true shape of section.

29. A cylinder of base diameter 50 mm and height 60 mm rests on its base on HP. It is cut by a plane perpendicular to VP and inclined at 45° to HP. The cutting plane meets the axis at a distance 15 mm from top to the base. Draw the sectional plan and true shape of section.

30. A cube of 60 mm side has its base edges equally inclined to VP. It is cut by a sectional plane perpendicular to VP, so that the true shape 0: cut section is a regular hexagon.

Locate the plane and determine the angle of inclination of the VT with the reference line XY. Draw the sectional top view.

31. A square pyramid base 40 mm side and axis 65 mm long has its base on H.P and all the edges of the base are equally inclined to V.P. It is cut by a section plane perpendicular to V.P. and inclined at 45° to H.P. and bisecting the axis. Draw its sectional top view, and the true shape of the section.

32. A cone of base 75 mm diameter and axis 80 mm long is resting on its base on the H.P. It is cut by a section plane perpendicular to the V.P. and parallel to and 12 mm away from one of its end generators. Draw its front view, sectional top view and true shape of the section.

33. A hexagonal pyramid of base side 25mm and axis 70mm long has the hexagonal end on VP, with two edges perpendicular to HP. A section plane perpendicular to VP and inclined at 30_0 to HP, cuts the pyramid at a point 8mm from the axis and above it. Draw the sectional top view. Also find true shape of the section.

34. A hexagonal pyramid of base 30mm and axis 70mm lies on HP on its base edge such that one of the slant faces is perpendicular to both the planes. Draw the projection. When it is cut by section plane parallel to HP and a distance 15mm from the apex point.

35. A vertical cylinder 40 mm diameter is cut by a vertical section plane making 30° to VP in such a way that the true shape of the section is a rectangle of 25 mm and 60 mm sides. Draw the projections and true shape of the section.

Development of surfaces

36. Draw the development of the lateral surface of the lower portion of a cylinder of diameter 50 mm and axis 70 mm. The solid is cut by a section plane inclined at 40° to H.P. and perpendicular to VP and passing through the midpoint of the axis.

37. A regular hexagonal pyramid side of base 30 mm and height 60 mm is resting vertically on its base on H.P. such that two of its sides of the base are perpendicular to V.P. It is cut by a plane inclined at 40° to H.P. and perpendicular to V.P. The cut ting plane bisects the axis of the pyramid. Obtain the development of the lateral surface of the truncated pyramid.

38. A hexagonal prism of base side 30 mm and axis length 65 mm is resting on HP on its base, with two of the vertical faces being parallel to VP. A circular hole of diameter 40

mm is drilled completely through the prism such that the axis of the hole is perpendicular to VP and bisects the axis of the prism. Draw the development of the lateral surface of the prism showing the shape of the holes formed on it.

39. A cone of base diameter 50 mm and height 75 mm rests vertically on its base on the ground. A string is wound around the curved surface of the cone starting from left extreme point on the base and ending at the same point. Find the shortest length of the string required. Also, trace the path of the string in the front and top views.

40. A pentagonal pyramid of base 30 mm side and height 70 mm stands with its base on the HP. such that one of the base edges is parallel to the VP. It is cut by a section plane perpendicular to the VP and inclined at 30_0 to the HP. bisecting the axis. Draw the development of the surface of the cut solid.

41. A cylinder of diameter 40 mm and height 50 mm is resting vertically on one of its ends on the HP. It is cut by a plane perpendicular to the VP and inclined at 30° to the HP. The plane meets the axis at a point 30 mm from the base. Draw the development of the lateral surface of the lower portion of the truncated cylinder.

42. A cone of base 60 mm and height 80 mm is resting with its base on HP. An insect starts from a point on the circumference of the base, goes round the solid and reaches the starting point in the shortest path. Find the distance travelled by the insect and also the projections of the path followed by it.

43. A pentagonal pyramid of-base edge 25 mm and height 60 mm rests vertically on its base on the HP such that one of its base edge parallel to VP. It is cut by a plane, inclined at 60° to HP and passes through a point 35 mm from the apex. Draw the development of the lateral surface of the pyramid.

44. A right circular cone, diameter40 mm base and 50 mm height, rests on its base on HP. A section plane perpendicular to VP and inclined to HP at 45° cuts the cone bisecting its axis. Draw projections of the truncated cone and develop its lateral surface.

45. A cube of 40 mm edge stands on one of its faces on HP with a vertical face making 45° to VP. A horizontal hole of 30 mm diameter is drilled centrally through the cube such that the hole passes through the opposite vertical edges of the cube. Draw the development of lateral surface of the cube with the hole.

46. A regular hexagonal pyramid side of base 30mm and height 60mm is resting vertically on its base on HP such that two of its sides of the base are perpendicular to VP. It is cut by a plane inclined at 40° to HP and perpendicular to VP. The cutting plane bisects the axis of the pyramid. Obtain the development of the lateral surface of the truncated pyramid.

Unit-5
Isometric projection
1. Draw the isometric view of a cylinder of diameter 46 mm and height 60 mm when it is resting on one of its ends on the HP. It is cut by a plane perpendicular to the VP and

inclined at 450 to the HP. The plane passes through a point on the axis located at 15 mm from the top.

2. Cone of diameter of base 60 mm and height 65 mm rests with its base on H.P. A cutting plane perpendicular to V.P. and inclined at 30° to H.P. cuts the cone such that it passes through a point on the axis at a distance of 30 mm above the base of the cone. Draw the isometric projection of the truncated cone showing the cut surface.

3. Draw the isometric view of a hexagonal pyramid of side of base 30mm and height 75mm, when it is resting on HP such that an edge of the base is parallel to VP.

4. A pentagonal pyramid, base 30mm and axis 65mm long, rests with its base on HP. An edge of the base is parallel to VP and nearer to it. A horizontal section plane cuts the pyramid and passes through a point on the axis at a distance of 25mm from and apex. Draw the isometric view of the frustum of the pyramid.

5. A pentagonal pyramid, 30mm edge of base and 65mm height stands on HP such that an edge of the base is parallel to VP and nearer to it. A section plane perpendicular to VP and inclined at 30° to HP cuts the pyramid passing through a point on the axis at a height of 35 mm from the base. Draw the isometric view of the truncated pyramid. Showing the cut surface.

6. A hexagonal prism, side of base 25 mm and height 50 mm rests on HP and one of the edges of its base is parallel to VP. A section plane perpendicular to VP and inclined at 45° to HP. bisects the axis of the prism. Draw the isometric view of the truncated portion of the prism, clearly showing the cut surface.

7. A cylinder 50mm diameter and 60mm height stands on HP. A section plane perpendicular to VP inclined at 55° to HP cuts the cylinder and passes through a point on the axis at a height of 40mm above the base. Draw the isometric view of the truncated portion of the cylinder when the cut surface is clearly visible to the observer.

8. The frustum of a pentagonal pyramid base 30mm side and top face 15mm side has a Height of 4Omm. Draw its isometric view.

9. A hexagonal prism of base side 20 mm and height 40 mm has a square hole of side 16 mm at the centre. The axes of the square and hexagon coincide. One of the faces of the square hole is parallel to the face of the hexagon. Draw the isometric projection of the prism with hole to full scale.

Perspective Projection

10. A regular hexagonal pyramid of base edge 20 mm and height 35 mm rests on its base on the ground plane with one of its base edges touching the picture plane. The station point is 30 mm above the ground plane and 40 mm in front of the PP. The central plane is 30 mm to the right of the axis. Draw the perspective projection of the pyramid.

11. A rectangular prism, sides of base 50x30mm and height 55mm, rests with its base on the ground plane. A vertical edge is in the picture plane and one of the longer edges of its base is inclined at 45° to PP and behind it. The station point is 50mm in front of PP, 75mm above the ground plane and lies in a central plane which passes through the center of the prism. Draw the perspective view.

12. A cylinder 30mm diameter and 40mm long is lying on the ground with its axis perpendicular to the picture plane. The nearest point of contact with the ground is

60mm on the left of the station point and 10mm from the PP. The station is 40mm above the ground and 60mm in front of the PP. draw the perspective view of the cylinder.

13. A square pyramid of the base 20mm and altitude 40mm rests on its base on the ground such that one of its base sides is parallel to the picture and 10mm in front of it. The station is 50mm in front of the picture plane, 25mm to the left of the axis of the pyramid and 55mm above the ground. Draw the perspective view of the pyramid.

14. A square prism of base 25x25mm and height 40mm rests on the GP with the edge of the base making 45° with PP. The comer nearest to the PP is 25mm to the right of the station point and 25mm behind the PP. The station is 55mm above the GP and 70mm in front of the PP. Draw the perspective view of the square prism.

15. A cube of side 25mm rests on one end of its faces on the ground the nearest vertical edge being 20mm behind the picture plane and 40mmto the left of the station point. A face containing the nearest vertical edge is inclined at 60° to the PP. The station point is 40mm above the ground and 60mm in front of the PP. Draw the perspective view of the cube.

16. A rectangular pyramid, base 30 mm x 20 mm and axis 35 mm long, is placed on the ground plane on its base, with the longer edge of the base parallel to and 30 mm behind the picture plane. The central plane is30 mm to the left of the apex and station point is 50 mm in front of the picture plane and 25 mm above the ground plane. Draw the perspective view of the pyramid.

17. A square prism of base 25 x 25 mm and height 40 mm is resting on the GP on its square base with a right side rectangular face making 60° with Picture Plane. The corner nearest to the PP is 40 mm to the left of the station point and 20 mm behind the PP. The station point is 60 mm above the GP and 50 mm in front of the PP. Draw the perspective view of the prism by using Visual Ray Method