Engineering/Architectural Graphics – Part 1
Orthographic Projection
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Lecture – 22
Projection of a Plane Perpendicular to One and Parallel to Another Plane

Good morning, welcome to the second lecture of this week 5 for the ongoing online course on engineering drawing or architectural graphics, where we are discussing about the orthographic projections of planes. In the first lecture of this week, we have discussed about the orthographic projections of planes which are perpendicular to both the reference planes. So, both VP and HP.

So, we saw how to draw and I had given you an exercise of drawing orthographic projections of a hexagon with some given conditions to be drawn. Here, I have the solution ready for that problem and you can just tally so, that you are familiar whether you are going in the right direction and if you still have some doubt, you can come back.

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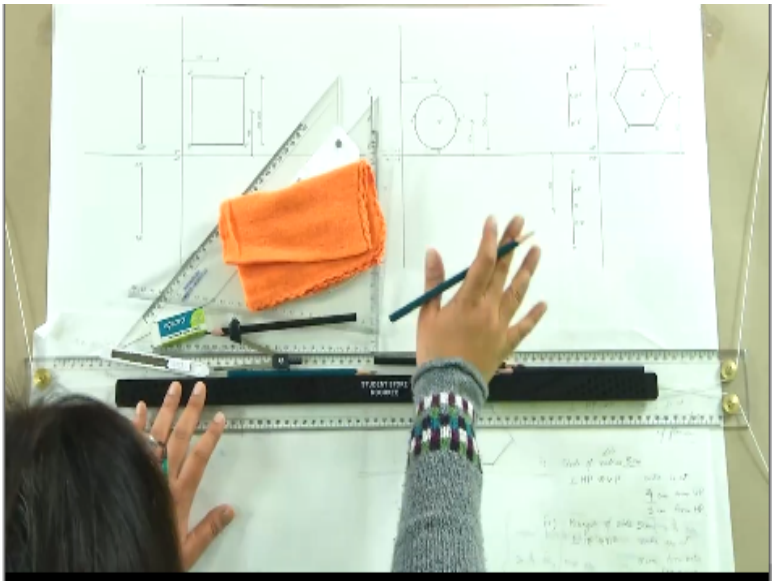

So, we will quickly revisit the previous lecture and the question that I had given you and its solution here. So, we had to draw a hexagon of side 3 centimetre which was perpendicular to both HP and VP and its centre is at 5 centimetre from both HP and VP. So, the first thing that

we know clearly is that this hexagon will be seen in its true shape in the side plane and then we will be drawing its centre first to start with.

So, we have the centre at 5 centimetre from both HP and VP. So, what I did I marked a centre which is O, 5 centimetre from both HP and VP which is here and then I drew a circle around it taking the centre I first drew a circle which will circumscribe the hexagon and then I drew a hexagon. Another condition which was given that it has the hexagon has 2 sides parallel to HP. So, we took it parallel to HP.

If it was perpendicular to HP or parallel to VP, we would have got hexagon which would have 2 sides perpendicular to HP like this. In this condition, this is the hexagon. Once we have drawn the hexagon, we will take the projections onto the VP and then HP. Now, we will do the labelling to mark what is seen. So, the centre was marked as O and the hexagon A, B, C, D, E, F and if you look at it now, so, what is this point?

This is point B seen first because we are seeing from this side; this is the front because this is VP. So, we are seeing it from this side. So, B dash, A dash, C dash, O dash, F dash, D dash, E dash which is here and when we see it from the top, what do we see first? We see A B, A B, B C and F C here, O in the centre and E and D beneath A and B. So, A, E and B, D in the same position.

Now, when I started 2 dimension, I have the hexagon of side 3 centimetre. So, I have given hexagon of side 30 mm here and then 50 mm from HP and 50 from VP. Now, if I were to take 50 from VP here, this dimension line would be intersected by a projection line. So, I prefer to represent this distance from VP here, in HP and this is what your final solution would be. I am hoping that all of you have got the similar solution and if not, you can watch it again and see what are the steps to be followed and where did you go wrong.

Now, we will move on to planes which are parallel to one of the planes, one of the reference planes and perpendicular to the other plane. **(Video Starts: 04:21)** So, let us see this is the quadrate which we have and for the reference for example, I have a plane a triangular plane.

It could be any shape. Now, the condition given is that this plane is parallel to one of the planes and perpendicular to the other plane.

So, what we have? Say, this plane is parallel to horizontal plane. So, we have this plane parallel to horizontal plane, it could be at any distance and now this is perpendicular to VP. So, what do we see? In case, we have a condition like this where do we see the true picture, true dimension of the screen. We will definitely be seeing it in horizontal plane, because this plane is parallel to horizontal plane and it is perpendicular to VP.

So, in VP, what do we see? We just see a line. Again, this plane is a combination of various lines. So, in this case, it is a combination of these 3 lines. Now, how are these 3 lines placed? The plane entirely is parallel, but this line could be making an angle with the VP and parallel to HP. Similarly, the other 2 lines, the given condition is that all these 3 lines which constitute this plane are going to remain parallel to HP.

So, we will see the true dimensions in HP and some skewed dimensions, some diminished dimensions in VP. How do we draw that depends upon the conditions which are given? Suppose, we have an equilateral triangle and one of the sides of this equilateral triangle makes an angle of 30 degree with the VP. So, we will have to draw it accordingly. So, depending upon the condition, we will then move it.

What if the plane is perpendicular to the HP but parallel to the VP? So, what we have here is, this is a plane or triangular plane again which is parallel to VP and perpendicular to HP. So, in this case, what do we see? We see the true shape of this plane reflected projected onto the VP and in HP, we again see a single line which is exactly the same fundamental which we have been following so far.

What will be the projection? What will be the reflection? Will depend upon what condition have we been given for its positioning? how is this triangle positioned? The 2 conditions which are clear are that it is parallel to one of the planes and perpendicular to the other plane. So, that is clear. Other conditions will vary depending upon what is the plane and how it is placed.

So, let us see some of the examples of how to draw a plane which is perpendicular to one of the reference plates and parallel to the other reference plane and then see how to draw its orthographic projection. **(Video Ends: 04:21)** So, let us see how to draw projections of planes which are parallel to one of the reference planes and perpendicular to the other. So, here to demonstrate I am taking this example of rectangular plane.

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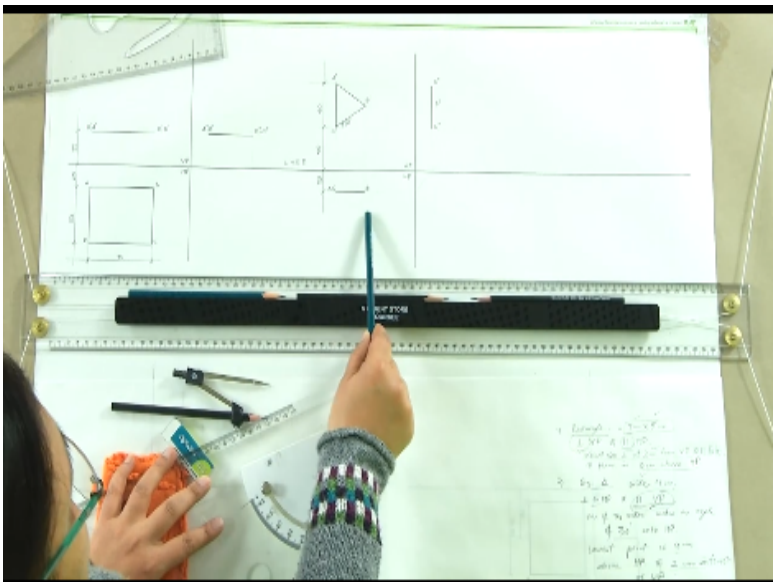

Now, let us assume that we have a rectangle which is the dimension of which is 7 centimetre by say, 5 centimetres. Now, this rectangular plane is perpendicular to VP and parallel to HP and also another condition that we have is that it is the closest side is at 2 centimetre from VP and the plane is 3 centimetre above HP. This is the given condition. So, the closest side is 2 centimetre from VP and parallel to it. So, that is that is the condition given.

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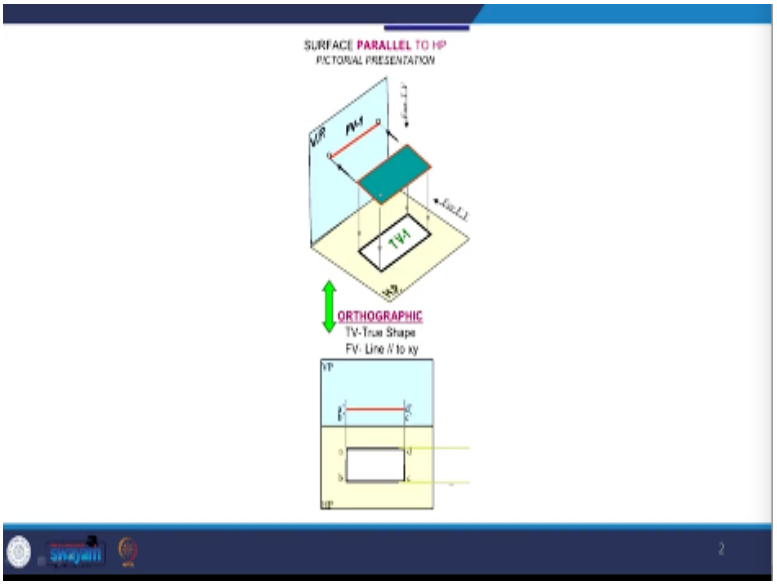

Now, if you look at the screen, we can see this given condition. So, we have a rectangle which is perpendicular to VP which is seen perpendicular to VP and parallel to HP. So, we will be seeing its true projection in HP and just a line in VP. Now, it says, there are other conditions given. In case, this rectangle was inclined at an angle to VP. Then in that case we would have seen this rectangle having all its side at making some angle with the VP but here in this case it is perpendicular to VP and parallel to HP.

It is not making any angle with the VP. So, this is what we are going to draw. Now, let us see the steps which are involved in this work. So, what we have? We have the plane which is the side and it is the closest side is that 2 centimetre from VP. So, let us draw the closest side at which is the guiding line. So, at 2 centimetres from VP which will be seen in the HP. So, this is where the closer side of the rectangle is going to be seen and it is 3 centimetre above HP.

So, we again draw a line which is at 3 centimetre from HP. This is where we will be seeing its reflection or different elevation reflection in VP. Now, we have the rectangle as 7 centimetre by 5 centimetre. So, we measure 7 centimetre by 5 centimetre in HP, because, that is where the 2 dimensions are being seen. So, what we have is this rectangle of 7 centimetre by 5 centimetre having its closest side from at 2 centimetre from VP and this rectangle is perpendicular to VP and parallel to HP and at 3 centimetre above HP.

So, what we have done already is we have drawn all these; we have fulfilled all these conditions here in this drawing. So, this drawing is our final projection. Let us just darken (11:28) it. We have taken the projections. So, let us darken (11:41) in the projections. Now, if we have to draw the side elevation of this, since this plane is parallel to HP and perpendicular to VP and if you visualise it, this plane is going to be perpendicular to your side elevation as well.

So, we will be taking the projections and as you will deduce the side projection, the projections on the side plane, you will see that it is actually perpendicular to the side plane as well. So, what do we get here? We get a line. I have already drawn the line, but let me just start by labelling it. So, what we have here is a rectangle, say A, B, C, D. This is the rectangle. Now, when we see this rectangle is parallel to HP, when we see it from the front, what do we see?

We see D first. It is a D and behind D, we have an A. Here, we see C and behind C, we have a B. Here, when we see it from the side, what do we see first? We see an A. So, as we go, this is the A and behind A is also the B. Now, we see D here and this is the point; this is the line where D is coming from the elevation also. So, we see D. So, D double dash, C double dash, this is not DC. This is D double dash, C double dash. This is A double dash, B double dash. This is what we are seeing here.

So, this is the projection of a rectangular plane which is perpendicular to VP and parallel to HP. And what we see here is VP, HP and this is the side elevation. So in this case, this is the left hand side elevation. This is the projection of this rectangle and now, we have to quickly dimension it. So, we have 2 dimension this rectangle and only the conditions which are given here. So, let us see what all are we going to dimension.

So, we have this rectangle 7 centimetres by 5 centimetres. So, we have 70 here and we have 50 here. So, we have already represented the dimensions. Then this is the closest lie side is at 2 centimetres from VP. So, we have 20 here, which is the distance which it makes from VP and we have it 3 centimetres above HP. So, this is 30 above HP. So, these are the 5 dimensions, 4 dimensions which are given and there is no other dimension.

The other thing which is this condition which is evident from this drawing. So, this is how we would draw this particular exercise the projections of this rectangular plane. Now, let us see another example of a plane which is perpendicular to one of the reference planes and parallel to the other reference plane. So, here we are taking an equilateral triangle of say side 4 centimetres. Now, in this case, it is perpendicular to HP and parallel to VP.

So, we know that this will be seen in its true shape in VP and we will be seeing a line in HP now. Let us say that it is placed in such a manner the plane is perpendicular to HP and parallel to VP, but, the plane, the lines of this plane, one of the lines, so, one of the sides makes an angle of 30 degree with HP. So, it is making an angle of 30 degree, not the plane but the side of the plane is making an angle of 30 degree with HP.

So, we have it perpendicular to HP and parallel to VP. It has its side 4 centimetre and one of its sides make an angle of 30 degree with HP and lowest point is 4 centimetre above HP. We would need to know the reference of this. So, the lowest point is 4 centimetre above HP and 2 centimetre in front of VP. Now, let us start drawing this. So, what we are going to see? We are going to see the true shape in VP and we will start.

So, 2 centimetre in front of VP is what we are going to see in HP. So, let us mark this 2 centimetre in front of VP, which is where your plan in horizontal plane would come which will eventually be aligned and the lowest point is 4 centimetre above HP. So, we have the lowest point at 4 centimetre above HP. So, we have a point somewhere here, which is the reference point for us to start drawing our triangle.

Now, this is an equally true triangle and what we have is, we have the side of this as 4 centimetre and one of the sides makes an angle of 30 degrees with HP. So, suppose, we draw this line starting from this point, which is fulfilling these 2 conditions at an angle of 30 degree. Now, this triangle has a side of 4 centimetres, so, we mark 4 centimetres here. So, this is the line which makes an angle of 30 degrees with HP which is the reference here and now we have to draw the equilateral triangle.

So, this is 30 degrees and the angle which is made between the angle of this equilateral triangle is 60 degrees each. So, what we have is, we have a line here and then we have. So, we could draw it using compass or you could just deduce the angles or you could draw it using the angles. So, this is our equilateral triangle in question. So, what we have here is this.

Now, let us draw the projections of this triangle, since, what these points are going to be in the same line. This is what we get. So, 2 points on the same line represented or projected using the same projector and one projector for the other one and let us simultaneously draw the projection lines for the side plane as well. So, let us extend the projection lines to be taken to the side plane. Now, what do we get here?

We get a straight line in HP, which is how it should have been because it is perpendicular to HP, then it is parallel to VP which is where we are seeing the true shape. Now, let us start labelling it. So, what we have is a triangle say A, B, C. This is the front elevation of it. Now, if you see it in the plan, what do you get? You get A, C and B here because from the top you will see A first and then you will see C. So, A, C, B here.

Now, let us take it to the side elevation, what do you have A coming and meeting with A here? So, this is the point A double dash, B and B double dash. So, this is the point B double dash and C here. So, what we see? We see 3 distinct points in side elevation. So, we see 3 distinct points in side elevation, but it is still a line. Similarly, in HP, we see a straight line with 3 points where A and C are represented by the same point on this line A, C, B.

And in the front elevation, we see the true shape of the triangle which is how it should be because it is parallel to VP. So, this is what we get as the orthographic projection of this and now, what we have to label is each one of this. So, what we have? We have a triangle of side 4 centimetres. So, we have 40 here. Now the angle which the side makes with HP is 30 degrees.

So, you mark 30 degrees here which is this. The other thing lowest point is that 4 centimetre above HP. So, above HP, it is 4 centimetre and 2 centimetre in front of VP. So in front of VP, it is 2 centimetres again. So, it is 20 here. We do not need to mention any other dimension

anywhere. Please remember that we will only dimension where the true dimensions or true angles or shapes are being seen. We will never write any dimension here.

What is this distance? It is none of our concern, though this side is also 40 but we are not going to dimension it. We are not going to write it. So, this is how we draw the projections of this equilateral triangle which is parallel to VP and perpendicular to HP and with these given dimensions and conditions. So, I hope with this you have fairly under how to draw orthographic projections of planes which are parallel to one of the planes and perpendicular to the other plane.

In the coming weeks, we will be discussing about planes which are inclined to one of the plane, reference planes and making an perpendicular or parallel to the other plane and subsequently moving on to little more complicated of these planes which are oblique planes which are inclined to both planes. So, see you again in the next lecture. Till then, bye, bye. Thank you.