**Module - 04
Lecture - 33
Orthographic Projections II (Part - 3)**

Hello all, welcome to our NPTEL Online Certification Courses on Engineering Drawing and Computer Graphics. We are at lecture number 33. There we are covering how to draw point projections and line projections onto different planes.

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Let us look at that through an example. So, in this example draw projections of an 80 mm long line PQ. Its end P is 10 mm above the horizontal plane and 10 mm in front of the vertical plane.

And, this line is parallel to the vertical plane and inclined to the horizontal plane at 30 degrees. First of all, have some visualization of that to do any engineering drawing one should have that visual. This is the vertical plane and perhaps this is the horizontal plane, maybe at the backside also it goes, let us name it a horizontal plane.

It is an 80 mm long PQ line; its end P is 10 mm above the horizontal plane. So, somewhere on above; that means, top of that we should have and 10 mm in front of PP it can be here or there.

But it mentions that it is in front of the VP. So, P point maybe somewhere there and to put it in this way is 10 mm above that 10 mm in front. So, precisely on the square, we will have that PQ point. Let us use another colour, this is P. We do not know where exactly this Q point is from this information.

But it is an 80 mm long line. It can be in that direction, it can be in that direction, it can be in any direction. The other condition what they have given is this line should be parallel to the vertical plane. So, any line parallel to vertical plane may be in that direction, maybe in that direction we will have, but it should not make any inclination angle with the vertical plane, this is the first condition.

The second one is inclined to HP at 30 degrees; that means, if we are drawing an 80 degrees line, 80 mm line is supposed to make an intersection with the horizontal plane somewhere, vice versa, if we are drawing a line parallel to this XY axis, is supposed to make an angle with the horizontal plane which we call 30 degrees theta is equal to 30 degrees.

So, the other point Q must be somewhere here. And, the projection of this PQ line onto that vertical plane gives us the true length of that object. So, this supposed to be 80 mm on the vertical plane. This is the way the line in 3 D supposed to look like. And, what we are more interested in is projections?

So, P point we have to map top' small letter q point we have to map to q', once done project this a point down rotates it by 90 degrees. So, somewhere here p, similarly project this Q down onto that plane. So, it appears in that way and rotates it by 90 degrees. So, that we will get Q. Then, join p q join p q'. This is the way we should construct a line on this plane.

So, if we are visualizing only on vertical and horizontal planes, on the vertical plane. If this is the x y-axis, this p q line will be p' q' will be like that. On the horizontal plane, if we are looking from top view it makes projection p here and projection q here. So, it looks like that. This is the way the visual supposed to look like.

So, let us look at the solution. I am sorry this point supposed to be P Q points with p q, p', and q', and this angle is theta. Let us draw this line after understanding these projections. First of all, we have to draw an XY line.

This is the X-axis, Y-axis. First, we have to project this point q, this is q, and this is p. First, we have to project this point p to the vertical plane. So, that p' we will get and that projection supposed to be is 10 mm above it; that means, at 10 mm we have to mark a point somewhere here.

Similarly, project q points on to the vertical plane, but that supposed to make 30 degrees angle. So, from here if we are going to make a horizontal line, first we have to locate 30 degrees to the horizontal plane.

So, 30 degrees to that horizontal plane, connect this line. In that way on that locate 80 mm use our scale locate somewhere there. So, this must be the point.

So, vertical plane points p' q' and join this by darker one, oh this is the one and make it 30 degrees. Once, it is done what we have to do project point p onto the vertical plane, rotate it by 90 degrees. So, for that purpose what we have to do? When we project p point, which is 30 mm here. Let us look at this project p point down of this distance, that distance is 10 mm in front of the vertical plane.

So, 10 mm line first we have to have it on the X-axis X Y-axis. So, that will be this one. So, project this horizontally on to that point. So, let us call this point p. Similarly, project this q down, because we do not know what will be the q, but we want to project this q down and transfer that length.

So, if we are projecting that line q down because this is the one which projects this length up to this. So, projection points are this. So, transfer this length from here, when we are projecting that point will be q, join these lines p.

Then make markings this will be 10 units, and this one also 10 units and this will be 80. So, one has to construct a normal, then show this length. So, this will be 80 units, let us name it and this will be 10 and this will be 10. This is the way we construct for a line on how to do these projections on the vertical plane, horizontal plane? And, this one what we call front view and this one top view.

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Let us move on to the next example. There is a straight line AB of 40 mm length has one of it is ends A at 10 mm in front of HP. So, if we are again drawing this picture, the schematic what one should have in mind always, this is the vertical plane, this is the horizontal plane, let us call horizontal plane, this is vertical plane and this is the x y-axis.

It is a straight line of 40 mm in length. One of it ends A at 10 mm from HP 10 mm so, it can be down it can be above and 15 mm from the VP. So, if we are making a guess this point might be above horizontal plane at 10 mm and above that maybe 15 mm let us use, if it is 10 mm and 15 mm somewhere here, I can locate the point.

So, this point let us call A, somewhere in the 3 dimensions. So, if we have projections it makes in that way, that way. And, it is 40 mm in length. Draw the projections of the line if it is parallel to vertical plane and incline 30 degrees to the horizontal plane. Is supposed to make 30 degrees to the horizontal plane, 30 degrees to the horizontal plane and it is parallel means it should be in that way.

So, let us look at that. If we do that same as the earlier problem, we will get that these 30 degrees line, the 30 degrees angle we will be in a position to see projection here a' projection, b'. So, join a b' we see it like 30 degrees there. So, first of all, we have to construct above 30 mm a horizontal line 30 degrees and from there 40 degrees arc to make it b'.

Once it is done a project that down. Rotate this plane by 90 degrees clockwise again 15 mm down. So, we can mark a project b' down so, that we will get b. If this a b line is in the 1st quadrant this is the solution what we should get?

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Let us ask a question if this line a b is not in the 1st quadrant. Maybe, it is in 3rd quadrant, it may be in 2nd quadrant, it may be in the 1st quadrant. How the result changes? Let us look at that.

Now, if it is in the 3rd quadrant, what will happen? First of all, have feeling this is the vertical plane, horizontal and your AB line, this is a horizontal plane, this is the vertical plane, our A point 10 mm below HP somewhere here and in front of it 15 mm. So, let us call point A. And, it is going to make 30 degrees to the horizontal plane; that means, it and is supposed to be parallel to that vertical plane.

If that is the case the way how this line is supposed to make 30 degrees, but it should not intersect a vertical plane, it should be parallel to that. So, the line supposed to go parallelly to that vertical plane, but when we are looking at the horizontal plane is supposed to make 30 degrees. So, it will be at that location B.

What we have to do is? Project this onto this plane then we have a line. So, our vertical plane now looks like this. So, our points let us darken it. So, this will be the a point. So, small a' this will be the b'. A will be projected and the plane has to be rotated by 90 degrees and there will be the point, b has to be projected and that point will be a and b.

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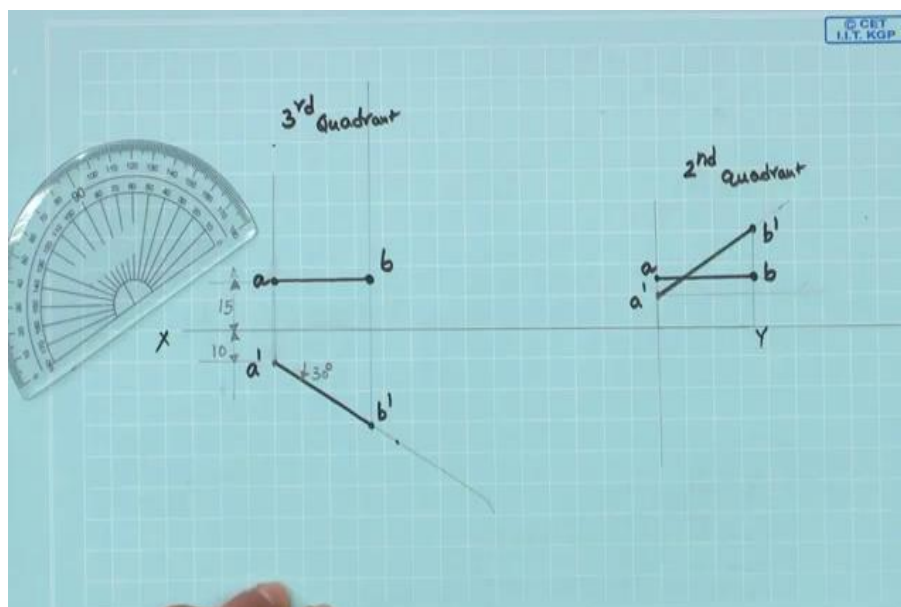
So, let us draw that on our sheet first thing what we have to do draw a horizontal line. This is the X-axis, Y-axis. Locate a point a' 10 mm below, we will project it all the time somewhere there. Let us call a' and b' we have to locate.

So, somewhere there join this line in that locate 40 mm line. So, this will be b' join these points, this will be our front view. Then project a' up on to the horizontal plane and then rotate it by 90 degrees.

That means, first of all, we have to project it, this is the way we have to project, 15 mm we have to make it because it is in front of VP; that means, projecting on to that plane whatever in front of VP rotated by 90 degrees.

If that is the case at 15 mm, we have to mark a point somewhere there a; b' the point we will straight away project it. The project so, 90 degrees lines we have to draw. So, let us move our roller scaler in that way and again parallel to a b line. Then, darken this line at that intersection this will be our b.

Then make marking oh I am sorry marking up to a point. So, it is up to A part down. And, similarly A part down. So, we have this extension lines, there and there and this will be 15 mm and this will be 10 mm. And, this angle 30 degrees. This is the way we project the same line in the 3rd quadrant.

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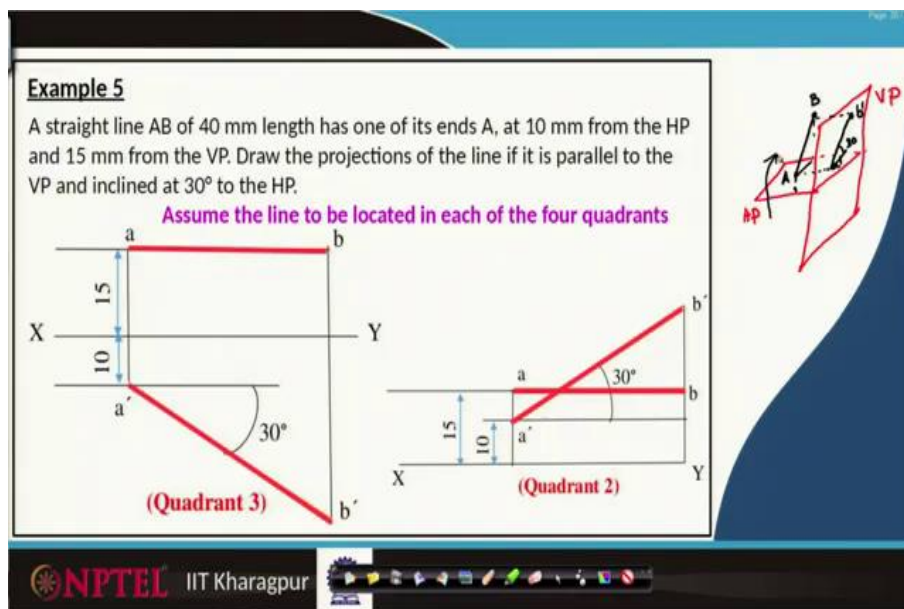
Let us ask a question if it is in 2nd quadrant how it looks like? Again, what we have to do? This is the vertical plane, vertical plane, horizontal plane, and our point, our point is 15 mm from the VP somewhere here, and 10 mm from HP somewhere there, 10 mm 15 mm somewhere there.

Now, this A makes 30 degrees to the horizontal plane. So, the point supposed to go it in that direction. So, this is A point, this is B point, project this one a' project that b'. So, we will be in a position to see that as a projection 30 degrees a' b'. Project this one A down project this one B all the way somewhere. So, that will be that line and our convention is rotate this horizontal plane by 90 degrees.

Let us look at how to draw that? So, let us use the same drawing sheet, but with certain offset, mark this one this is 3rd quadrant. And, here somewhere we have to mark first of all a'; a' is always be 10.

Then it is supposed to make 30 degrees with respect to horizontal, if we are picking supposed to make 30 degrees, somewhere there join this line 40 degrees a b. So, true projection we will see. So, must be there. So, this must be b' join this line. Once done a' has to be. So, it is in the second quadrant. So, this point has to be projected onto the horizontal plane and rotate it by 90 degrees.

If, that is the case what we have to do a project that onto the horizontal plane. Any parallel plane is horizontal plane and that gives us a feeling like 15 mm I have to locate.

So, 15 mm somewhere. So, let us mark that one as a point and b have to be projected down and draw a horizontal plane, which we are going to rotate it. So, this must be ab and name it the second quadrant ok, this is the way we construct in different quadrants.

Can you think about how to construct the same thing in quadrant IV? The b line itself is in quadrant IV if that is the case where exactly your front view will be and the top view will be. Yes, you are right the front view will be at the bottom level and the horizontal projection what we do constructing top view also that comes at the bottom.

So, thank you very much in the next class we will learn more about these line projections.