Engineering Drawing and Computer Graphics
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Module – 04
Lecture – 36
Orthographic Projections II (Part – 6)

Hello all, welcome to our NPTEL Online Certification Courses on Engineering Drawing and Computer Graphics. We are in module number-4 and lecture number-36 on Orthographic Projections. And we are working out a few examples on line projections.

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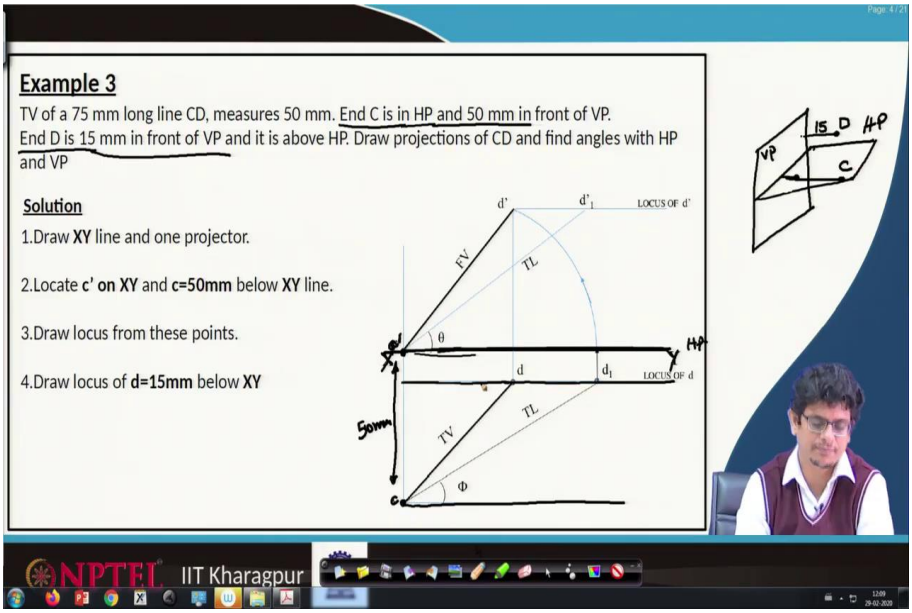

Let us begin. The third example is there is a top view in that 75 mm long line CD which measures 50 mm, and its end C is in the horizontal plane and 50 mm in front of the vertical plane. End D is 55 mm in front of a VP and it is above HP plane. If that is the case draw projections of CD and find angles with the horizontal plane and vertical plane. Let us look at the solution.

So, here the XY plane first one has to construct. We can see end C is in the horizontal plane. So, when it is in the horizontal plane, the projections, if we are seeing that, it will be on the XY axis, so one of these projections has to pass through that point.

And now we have to locate c' which is on XY which is horizontal plane and c 50 mm below that XY plane because its end c is in the horizontal plane and 50 mm in front of the vertical plane.

So, when we have such kind of line in 3D pictorial view, if this is the horizontal plane, in front of a vertical plane at 50 mm, our line point begins in capital C that is something like 50 mm, and it is in this plane. So, locate that c point. Then draw locus from these points. So, we have two points - c and c'; this is the locus line.

Then draw another locus line 15 mm, because this end D is 15 mm in front of the vertical plane. So, from the vertical plane we do not know whether it is here, here, and so on so somewhere here.

This point is at 15 mm, so this is the one because c is at 50 mm is supposed to be there, and d is a bit closer so it is at that point. So, for that to identify that we are locating this entire thing as a locus.

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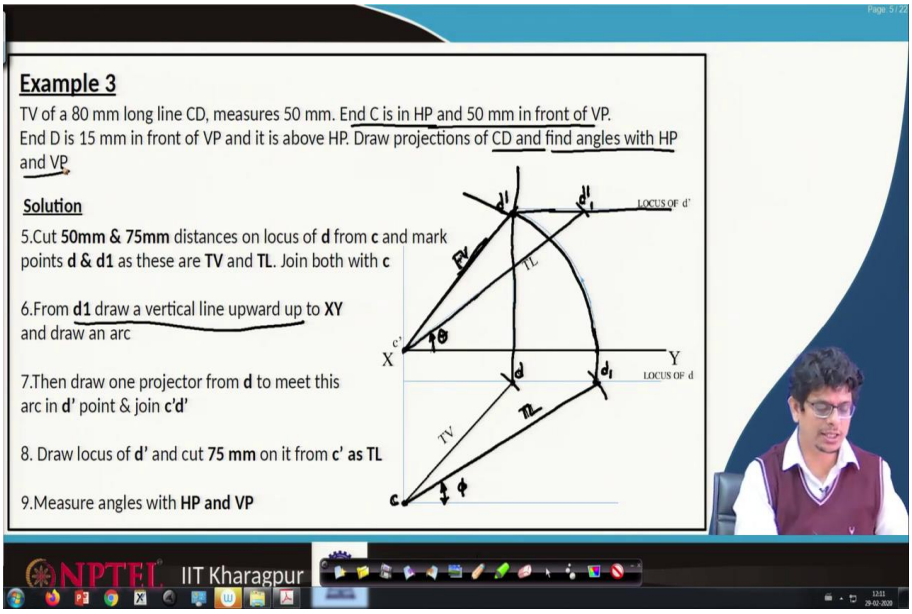

Once that is done, we have to make 50 mm and 75 mm distances on locus d from c. So, this is the c point locate 50 mm cut and also 75 mm cut, because end C is in HP and 50 mm in front of the vertical plane.

So, we will be in a position to cut here to locate d and to locate d 1', d 1. Then from d 1 draw a vertical line up to project it, which is point 6; and from there draw an arc by measuring c' to this projected line LFV, draw an arc, it can be extended all the way there.

We have already located d point, so draw a projector line which cuts that to indicates d'. Once we know d', join c' and d' and that will be the front view. Once we know d', draw a projector locus; already c to d 1 is our true length, so measure that c d 1 and from c' make a cut on to that locus called d' 1, this is the way we construct our diagram.

So, this again becomes true length and this angle is the true angle similarly the line c d 1' with horizontal axis whatever angle it's making true angle phi we will find. So, here unknowns are projections of CD that is our front view and top view and angles with the horizontal plane and vertical plane, these are the unknown things. So, let us do it on the sheet once again.

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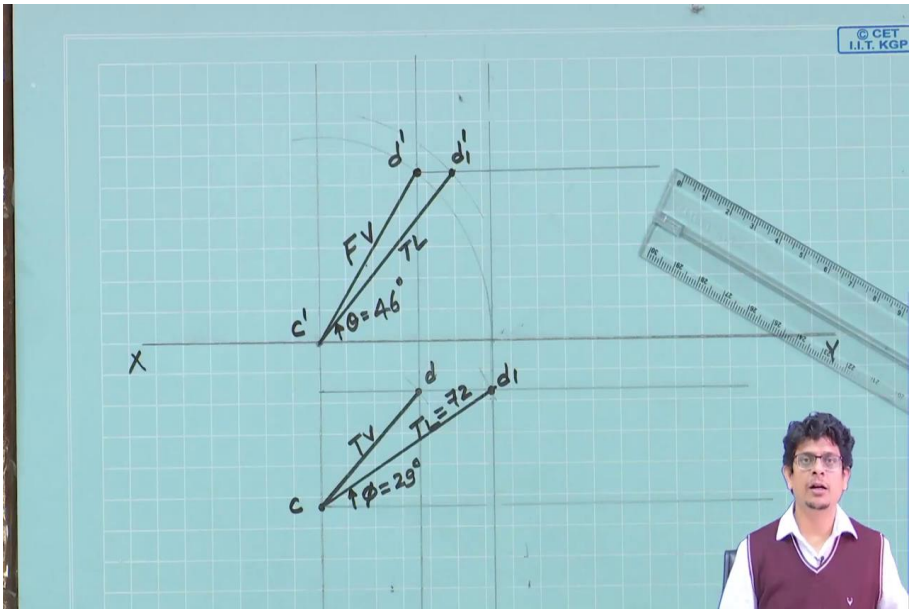

So, on the drawing sheet first, we have to draw a horizontal line XY; name this x-axis, y-axis. And draw a vertical line to locate this projector this is the projector, and our c' is already on the X-axis, XY axis so c'.

And c is 50 mm below that line or in front of the vertical plane, locate 50 mm here this is c. Draw locus from these planes in that way, similarly draw 15 mm locus line below XY axis, this is the line axis will be in a position to locate and d or d' will be at these levels.

Once done, make 50 mm cut. So, let us measure 50 mm to locate d lines, so this is 50 mm. So, we have to make a cut from c make an angle thereto locate d; then 75 mm we have to locate, 75 mm so this point, let us call d 1.

Join these points c d is our top view line, and true length line from c if we are joining d 1, this gives us our true length. Now, draw the projectors to locate top view and true length on that vertical plane.

So, this is one projector other one is this projector, this supposed to be a projector passing through ok, this is the line. Now, what we have to do is this angle we will measure, let us call phi, and this is true length, and this one is the top view.

Now, we have projected d 1 onto axis XY from there we have to rotate it to construct these views. So, let us measure this line; so, let us draw an arc which is passing through that already we know the true length, so locate true length on this axis this is the one which comes somewhere there; after drawing our locus we will be in a position to find it. Now, the locus for d is this d' the projector lines, and from c join this line to locate our front view.

Once the front view is there, the locus line passes by a d' and this point, because this length what we have transferred from here to there; we transfer it on that axis it cuts there, let us call d 1'.

Again, our true length in that vertical plane projected one, this is the one and this angle is theta. Let us measure this angle, the phi angle with horizontal it makes 29 degrees and the theta angle is 46, and true length is 72 mm, and this is also true length.

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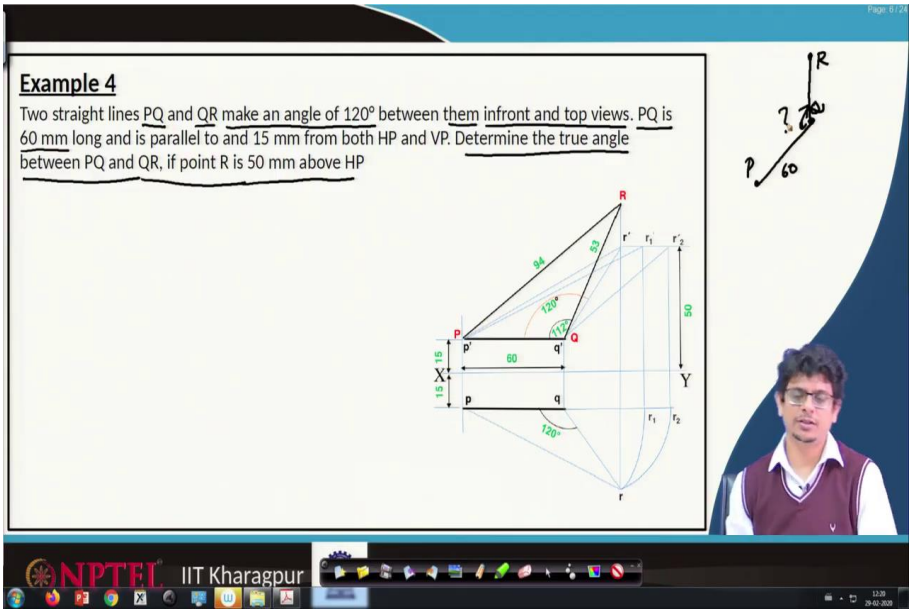

Now, let us solve one more problem for our projection of lines. So, let us look at the slide, here example 4; there are two straight lines PQ and QR. So, it is not just one line, but two lines PQ and QR, they make an angle of 120 degrees between them in front and top, in the front views and top views.

PQ is 60 millimetres long and is parallel to and 15 mm from both horizontal plane and vertical plane. If that is the case, determine the true angle between PQ and QR, if point R is 50 mm above the horizontal plane.

So, there are two lines P and Q these are true ones, and QR also there that means, the other line supposed to pass through Q maybe that is R; they make 120 degrees angle between them and these are in front in the top views. PQ length is 60 mm we know, and it is parallel to and 15 mm in front of HP and VP is both from horizontal plane and the vertical plane is at this 15 mm, if that is the case can we determine the true angle between this PQ.

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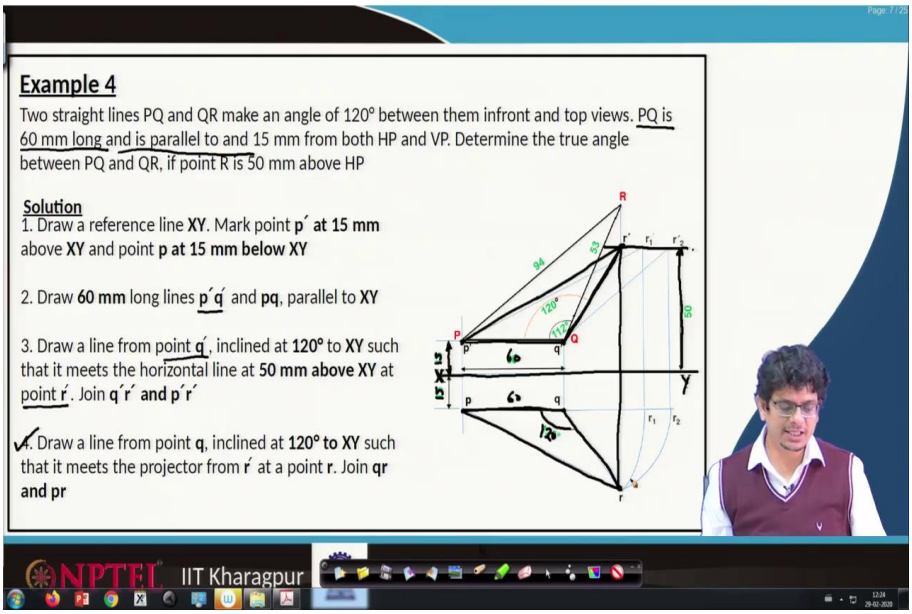

So, let us solve that problem step by step. First, draw a reference line XY on the plane, then mark a point p' 15 mm above HP, so this is 15 mm above that HP. In the front view, we are projecting that 15 mm, so that p' point will be at 15 mm.

Similarly, p point when we are looking from the top view that is in front, so 15 mm below. Then draw 60 mm long lines p dash q dash and p q parallel to XY axis. So, it is a line what we are seeing is projections in the front view and projection from the top in the top view.

So, from p point draw a projected line p' q', which is 60 mm PQ is 60 mm long, so 60 mm and it is parallel to this XY axis and 15 mm it is from both horizontal plane and vertical plane also.

So, once we are done with p' q' and p q which is also 60, the projected ones. We have to draw a line from point q', so we have located q' point and a 120 degrees line we will draw it in that way, and this meets the horizontal line at 50 mm above XY.

So, at 50 mm draw a horizontal line and let us call this point as r'. Once r' is located on that horizontal; we can connect q' and r', q' is this r' is that join that line. And p' r' also we can construct p' r'; this is the way we construct it.

After that, the fourth one, draw a line from point q, from q draw a line which is at 120 degrees inclination angle in that way, 120 degrees for that and it meets the projector r', this is the projector line at this location and call r. Then join q r and join p r; this is r and then join this point p and r. First of all, let us construct these steps on our sheet.

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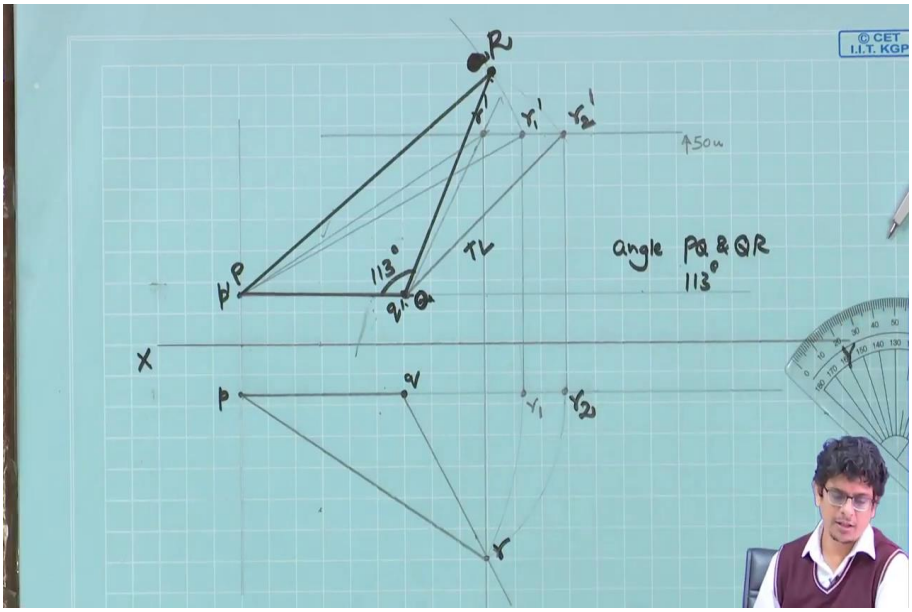

First, what we have to do, draw an XY line; X-axis Y-axis. Then mark points, so draw a projector line which is 15 mm above XY, locate that point p' lower case letter. Similarly, 15 mm below this one also, so let us call this point p. Draw horizontal lines, locus lines both from p and p', these are the projected lines.

Now, 60 mm long lines locate it; so here, and let us call this point as q'; similarly, this point is our q, join these lines. Now, from point q' 120 degrees to XY such that it meets a horizontal line at 50 mm above XY line.

So, first of all, let us locate 50 mm line on the sheet somewhere there, so locate that line. From q', let us locate this 120-degrees and let us call this point as r'. Once r' is there we can project that down to construct r. Already we know q from their 120 degrees angle we already knew, here construct to locate r, then join p and r p q r lines are projected in that way.

Let us join this p and r' also, p' and r'. Now, we have to locate r 1', r 2'. Let us call this is at 50 mm above on this, we are going to locate r 1' and other lines. Now, we have to draw this p q line p q' are parallel to XY, and they are representing true length side of p q's which are 60 mm things. Now, we have to draw an arc with centre p; let us look at our example 4 on the slide for the steps.

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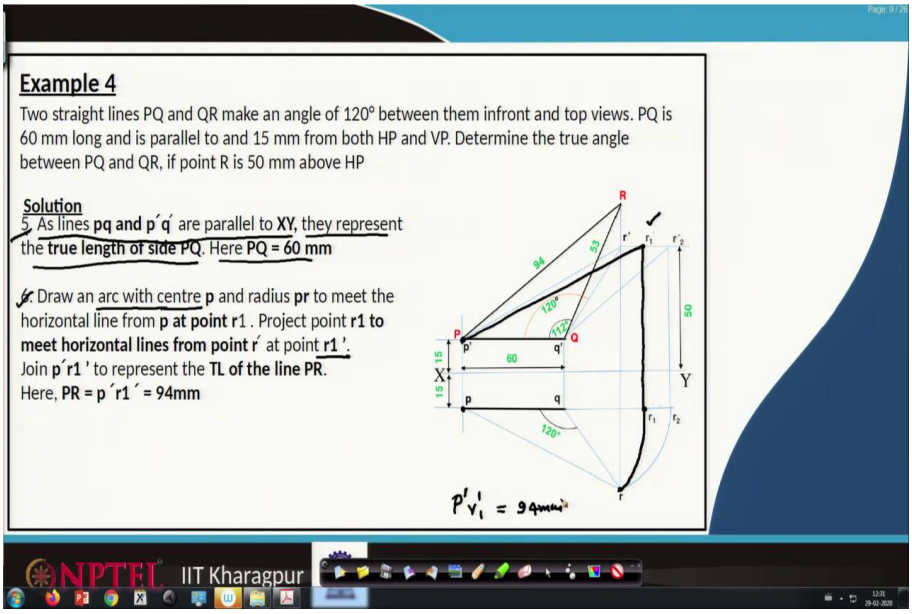

Once this construction is done, look at this step 5. As lines p q and p' q' are parallel to XY, they represent the true length side of PQ; here PQ is 60 mm. Now, we have to draw an arc with centre p from here, and radius pr that is this p to r, so that we can locate a point r 1; so, in this direction, we locate r 1.

After that project r1 up to locate r1', and then join p' r1' in that way, and this represents the true length of the line p and r. So, p q r are the things and what about the p to r that true length we will get it in this way.

So, p' r 1' we will get it as 94 mm, let us calculate that. So, on our drawing sheet, once we have located this p r locate, draw an arc have a projector for this point, this is r 1 project that let us call this one r 1' and join p r', p' r 1'.

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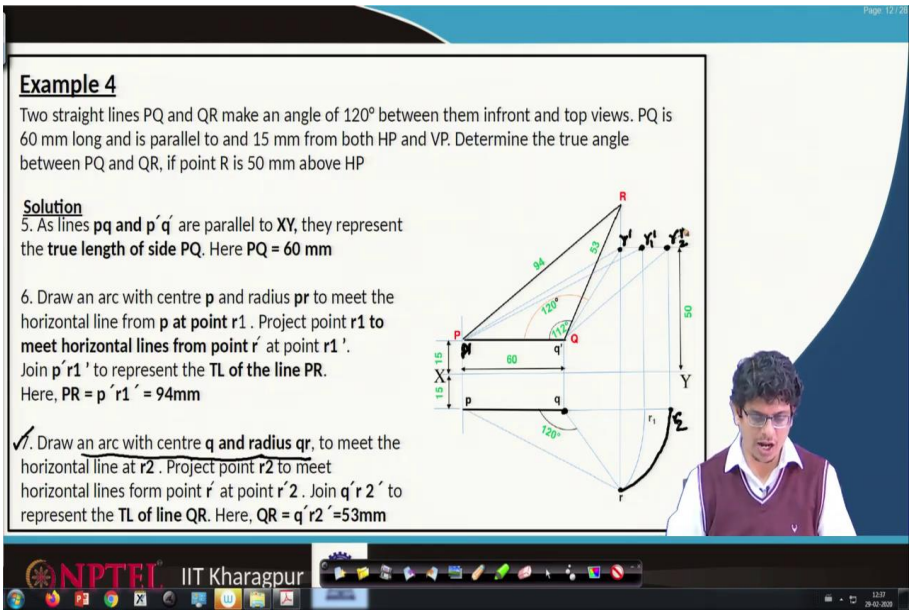

So, after drawing this p' r', p' r' and also p' r 1' connecting these points. Now, we will move on to seventh point; where we have to draw an arc with centre q and radius q r that is from q r radius to meet horizontal line at r2. So, with this radius, if we are going in this way we will locate r2, then project this r 2 all the way to locate r2'.

So, let us do that on our drawing sheet. We have located p and also r from r and q r radius, from qr radius project it on to this horizontal axis, to locate r 2 line. Once r2 line is there, join q' and r2'; so for that, we have to project this entire line here we have located r2', then join q' and r' r2'; q' here, r2' here.

So, from p and this is r we take an arc project it to r 2 line from there project it r2' we got it, and then join this q' r2' to represent the true length of a line qr.

So, this is the true length of our Q point Q to r, once it is done, we will draw an actual triangle, so we have to transfer this one to locate from p point r 1'. Similarly, locate from q1' r2'; if we are seeing this is the point what is intersecting.

So, now join these lines from p' join this one, rename this one as PQ line; and from here Q to R I am sorry, this is not this is R. So, we have a QR line which goes through that we have a P R line and we have a PQ line. Now, if we are seeing this, this angle the angle made by Q and R will be around 113 degrees.

And this length what is required, and this QR length what is required, this is the way we construct this true angle between PQ and QR. The PQ angle, so the angle between PQ and QR which is around 113 degrees.

Here 112 degrees, 113 degrees it is because of your drawing lines, how careful we are in terms of drawing it, how we are projecting it, based on that these one-two degrees angle always be fluctuating. And we will learn a new concept in the slide, it is what we call trace of a line.

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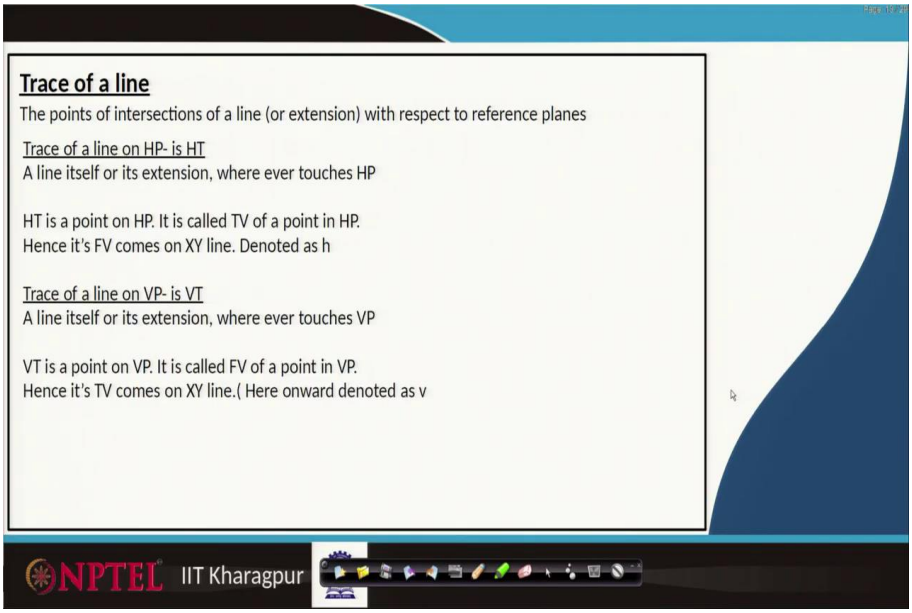

So, the point of intersections of a line or their extension with respect to the reference planes is called traces of a line. And there are a different kind of traces of a line with the horizontal plane and also vertical plane.

Let us look at with horizontal plane, a line itself or its intersection; if it touches a horizontal plane, we call trace of a line on the horizontal plane and usually we denote it by HT symbol. And this is a point on the horizontal plane, and it is called TV of a point in HP also; top view of a point in the horizontal plane, because it is intersecting when you are looking for.

For example, let us take a pen and that is going to touch this point. So, this is the line which is going to touch that so it is going to intersect this reference plane and that point what we are calling trace. And if it is going to intersect the horizontal plane, we call that one as HT point.

And when it comes to front view, straight away the projection comes to XY line because it is touching the point; so when you are projecting it, it goes on to that projection of that XY line and that point we usually denote it by h, a small h.

Similarly, if a line is touching the vertical plane the intersection point either that or the extension point that is what we call trace of a line on the vertical plane, and usually we denote it by VP VT. And this is a point on the vertical plane. And when we are looking from the top view, this point is intersecting with the XY axis, so we will see it on the XY axis.

More about traces and these lines, we will learn in the later classes along with our planes if they are going to intersect with these horizontal planes, vertical planes, how these planes we have to transfer it for different projections.

See you in the next class.