Engineering Drawing and Computer Graphics
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Module - 04
Lecture - 34
Orthographic Projections II (Part - 4)

Hello all, welcome to our NPTEL online certification courses on Engineering Drawing and Computer Graphics. We are covering module 4, lecture number 34, where we are covering Orthographic Projections Part II and especially the line projections.

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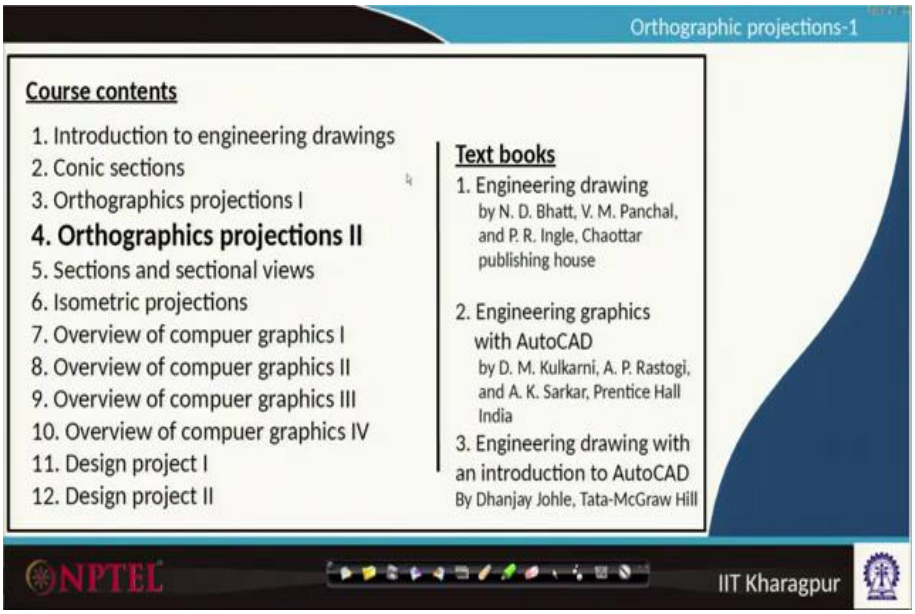

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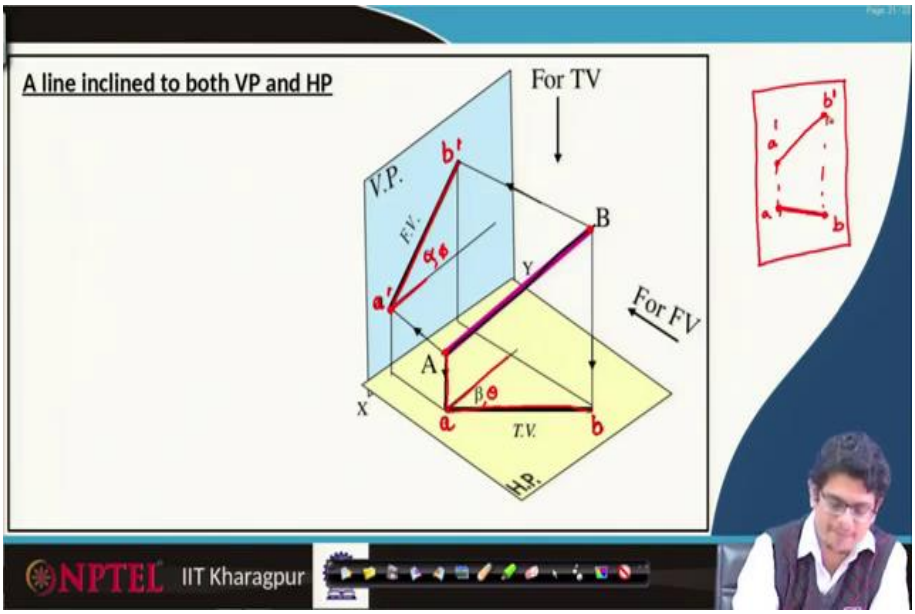

In this earlier we try to look at, if a line is parallel to one of the planes perhaps making an inclination angle with respect to the other plane, how to draw those lines?

Whether, it might be in the first quadrant, second quadrant, third or fourth quadrant, we try to look at its projections where one of the conditions is the line is parallel to one of the planes. If that violates for example, in general, a line which is inclined at different angles with the vertical plane and also the horizontal plane, then how to draw it is projections? There we will ask different questions if a line is known what is the angle it is making with the planes; we know how to draw projections?

The second question what we will ask is in case if we know the projections, how to construct find the true length of that line? So, the second question by knowing projections and constructing the true length is always slight complication involved, compared to the case where we know the true length and inclination angles made by that so, that we can construct projections. Both the cases we will try to look at that in our today's class. Let us begin.

Let us pick a, A B line this one. And, if we are seeing by projecting this A all the way down, we get a on the horizontal plane by projecting B, all the way down vertically we get b, this is the projection one. It makes an angle may be beta or theta with the horizontal plane.

Similarly, let us project A B points on 2 vertical planes, it makes a' and makes b'. So, the projection line is this. And, this one when we are looking at that with respect to the horizontal plane it makes an angle alpha or phi. These two angles the beta or theta, these two angles may be different in general if that is the case how to draw the projections of this line? That means, can we draw on the vertical plane the a', b', and then project it may be a and b.

The ab is not a true length nor a' b' is the true length. The true length always is a b. So, if I know the projections how to get that inverse problem one or if I know these angles and true lengths, how can I get this a' b', these are the questions what we will ask.

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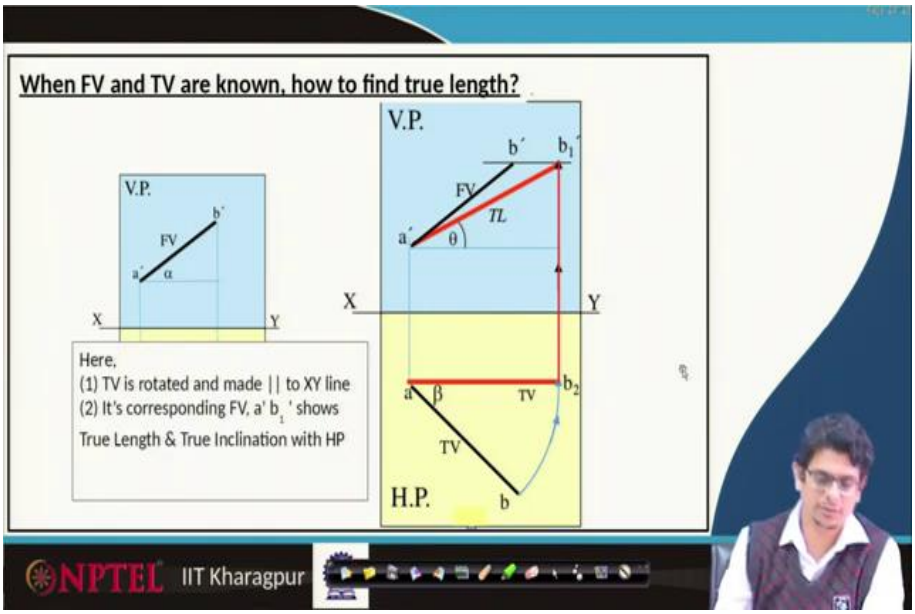

So, the angle made by this true length AB with respect to the vertical plane, that we will get it in the top view and the angle made by this true length with the horizontal we will see it on that vertical plane or in the front view. These are the directions what we will see.

For example, this angle with respect to a horizontal we will see it here. And, this angle the projected one with respect to vertical whatever the angle is going to intersect this vertical plane, whatever that angle we are going to see that we will see it here as beta.

Let us ask a question when front view and top view are not how to find true length? For that let us begin this story. Already, we might be knowing this front view and top few things. And, from there we would like to construct this true length.

For that what we have to do, let us assume we know already a' b'. And, we know them because if we want to construct a' b' we need to know how far this a' is located? Then what is the angle it is making in the last class what we have learnt, the angle made by that we go ahead cut it there make b'.

Similarly, project a' all the way down. So, that we will get a how far it is in front of this vertical plane, then project b', then rotate it in such a way that whatever the angle it is made that we will locate it. So, somehow, we know this front view and this top view also we know. If, that is the case how we are going to construct a true length is use a b, rotate it such that construct b 2 lines. AB is apparent a' b' is also apparent. Somehow, we have already constructed a' b' and AB.

Once, we know to use a b, project it back this a b onto the horizontal plane to locate b 2. Is more like getting this a b 2 line? Once, this a b 2 line is known we again project it back all the way up, a' b' line already known. So, b' line we project it to get b 1'. Once b 1' is on, a' to b 1' connect it and that is the true length. This is the way we construct this true length.

It is more like when we have this projected length in 3 D, let us look at this we already have AB thing. What we want to do is a project that one rotates it by horizontal direction; that means, this length we want to really rotate it. So, that we will be in a position to mark a point somewhere there, then transfer it all the way up. Then extend this line so, that we will be in a position to construct that true line, then, rotate it back, then we will be in a position to get that AB line, this is the way we construct it. The same procedure geometrically here we are doing it in that way.

By rotating it so, that I will get a b 2 then transfer that a b 2 all the way up, then extend this line get this one, this will be the true length. First, the top view is rotated, made parallel to XY line is a corresponding front view a b1' we will get it a' b1' and that shows the true length and true inclination angle with the horizontal plane.

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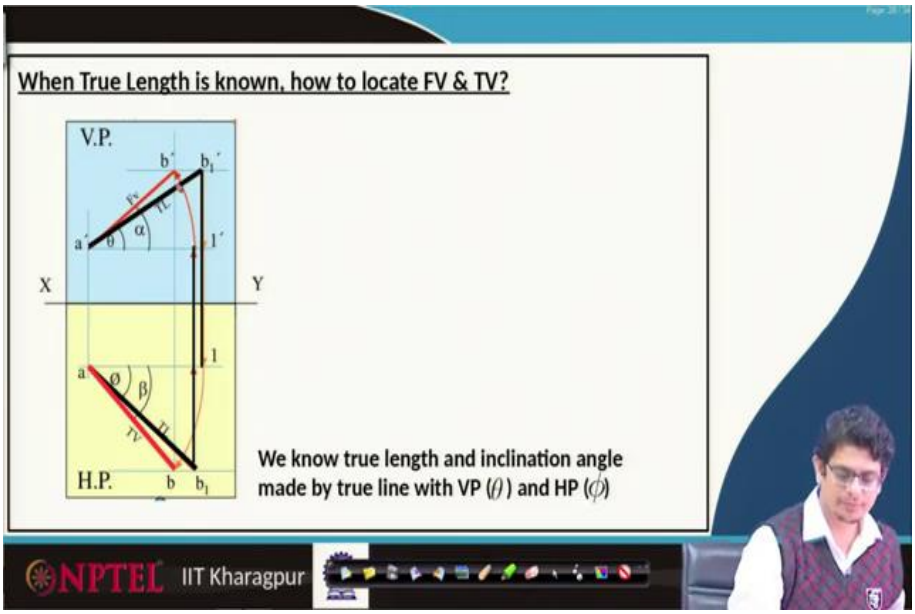

Let us ask another question when the true length is known how to locate front view and top view. So, for that purpose what we have to do, we know the true length and we know the inclination angle made by the true length with the vertical plane and also horizontal plane. This is a pretty straight forward problem, what we will do? Somehow, we already know that true length and angle made by the vertical plane, horizontal plane.

So, with the vertical plane angle what we will see it in the top view and the horizontal plane angle we will see it in the front view. So, true length we know with theta angle with the vertical plane construct it. Once, we know the true length constructing that a' b' we know, that is done. Similarly, a b also we know true length we construct it, with certain angle phi.

Once, this true length is known we project this all the way down. When it is done, we rotate it by 90 degrees all the way to construct a free angle. So, that is going to intersect at that point and we will be in a position to construct true length and the top view. So, let us do it once again. Once, we know this true length a' b 1', we project that all the way down, where we are going to construct this true length line, towards top view line, rotate that all the way to top view line which is making an angle phi and we will be in a position to construct this a b.

Once ab line is there and already true length line, we know project it back all the way up, all the way up, up to here, up to here rotate it all the way there so, that we will be in a position to construct, this front view.

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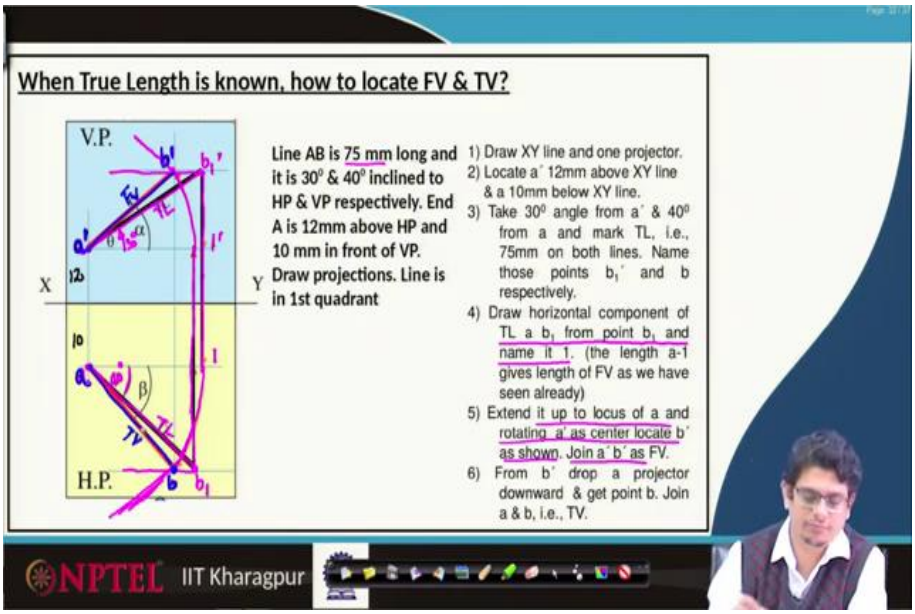

And A is 12 mm above HP and 10 mm in front of VP. First of all, visualize this point AB may be in the for first quadrant 12 mm above HP and 10 mm in front of VP. And, this true line 75 mm, it can be in any direction from that point a 70 75 mm, but it is supposed to make thirty degrees to the horizontal plane and 740 degrees to the vertical plane. That is the direction along which we will locate the point b I am sorry, let us look at the solution.

First of all, we have to draw the XY line. Let us draw this XY line. Then, locate 12 mm above XY line for a' we are locating 12 mm. And, 10 mm below XY line also because we are going to rotate that horizontal projection. So, below that will be 10 mm because that is the direction in front of VP which we are going to rotate it.

So, we have located this a also. Let us use some other colour magenta, we know a, we know a', these points are known. Now, what we have to do is 30 degrees with respect to the horizontal plane, which we will see it in the front view. So, take a 30-degree angle from a'. So, 30-degree angle a line we have to draw, in such a way that we will be in a position to mark true length 75 mm.

So, the 75 mm a line we will draw at 30-degree angle and it stops call that 1 b 1'. Similarly, pick 40-degree angle and locate this 75 mm length. So, from a draw 75 mm with an angle of 40 degrees both the lines we know so, the point we will locate b 1 and b 1'.

Now, we have to draw horizontal component of this true lengths. So, let us call this one true length, this is also true length lines. Once, we have that a horizontal component of true length a b 1 we are going to draw from point b 1. So, project this one all the way up to get horizontal component a b 1 from point b 1 and name it one somewhere we are going to name it.

Then length a 1, if we are similarly let us do it from b 1' also horizontal component 1 and 1'. If, we are looking a 1, this a 1 length we have to rotate it. So, if we are picking this a 1 compass to draw an arc, it goes via that point. Similarly, project this one radially in that direction. So, it makes another arc.

Extend it up to the locus of a and rotating a' as centre locate b' as shown. Then, join a' b' in the front view. So, what we have to do is? Here, we are going to rotate in such a way that, this b 1 we extend a line to locate b' there. Similarly, this b 1 we are extending in such a way that we locate b'.

Once these points are known; Let us use some blue colour, b point is known by extension of this line b' is known by extension of that line, we can connect it to get this apparent length lines, this is a this is a'. So, this will be the front view and this will be the top view of the system.

Let us repeat it once again. First, we have to identify this true line making an angle. Similarly, identify true line making an angle project it all the way there rotate it, similarly project this one all the way up rotates it. Already, we know this projection b 1 extend it to make cut b 1 also we know extend it make a cut, once it is done, we connect these lines to get the front view and top view.

Let us practice this example on the drawing sheet after that we will summarize the finding. So, the first thing as a practice; draw an XY line.

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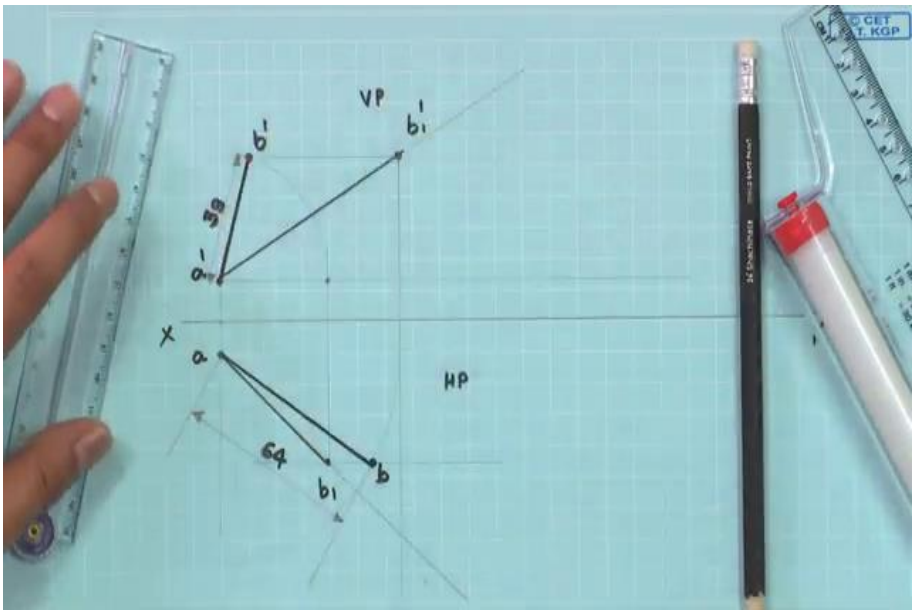

This is the XY line. The first step is to identify true line 75 mm. For that, we have to locate a' point which is 12 mm above the XY line. This is X-axis this is the Y-axis. Somewhere here we have to locate 12 mm so, 10, 11, 12 somewhere here.

So, let us call this' as a'. We have to take a 30-degree angle from a'. So, let us draw a horizontal line also here. And, there 30 angles we have to locate join these lines. And, what we have to locate is 75 mm locate that point this is our true length. So, join call b 1' and join these lines.

Similarly, let us locate that true line in the downward direction for that we have to project point a and that supposed to be 10 mm below XY line. So, this will be a point. And, that supposed to make 40 degrees with horizontal 30, 40 somewhere there. So, if we are joining this line, it makes an angle in that way.

Call this point our b1 and join this one. Do you see b1' b1 will be different when we have these projections? True lengths are done. Now, what we have to do is project these true lines all the way down, move parallel all the way down. Similarly, project these lines all the way parallel. So, on this projection mark that one which we have to transfer, let us mark that one as 1 and 1'. So, transfer this length in that way.

Similarly, transfer this length, because it is projecting onto a thing here something like that, that we have to project it all the way from this point so, project it in that way. Once,

we make arcs is quite easy for us to extend these true lines this must be the true line extend it in that way from b1' we have to really do. And, similarly, mark and arcs which are going to intersect.

So, this one will be intersected there join this line, this will be apparent 1 b'. Similarly, we have to extend b 1' in such a way that this length will be rotated. So, it is going to make it here. If, we are joining those lines and this one will be ab. And, let us find what are those lengths?

So, the projection length, so, let us note it down this is the vertical plane, this is a horizontal plane and what we are interested in is the projected lengths how much they are? If we measure that, it will be 61, 2, 3, 4, 64 units. So, 64 units we have to mark it. So, this will be parallel to a b line and this will be our 64 units.

Similarly, a' b' line it is 39 units. So, parallel to that if we are marking this will be 39. So, when a line is inclined to both vertical plane, horizontal plane, we have to use this kind of projections to construct this front view and top view of the system. Let us look at more problems in the next class.