Engineering Drawing and Computer Graphics
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Module – 04
Lecture – 32
Orthographic Projections II (Part - 2)

Hello everyone. Welcome to our NPTEL online certification courses on Engineering Drawing and Computer Graphics. We are covering module number 4, lecture number 32, on Orthographic Projections part 2.

In these orthographic projections part 2, we are mainly covering point projections, line projections. And how lines appear on horizontal planes, and vertical planes. If they are parallel to the planes, if they are perpendicular to the planes, and if they are inclined to the planes these are the basic construction for any engineering drawing. Let us move on to that module.

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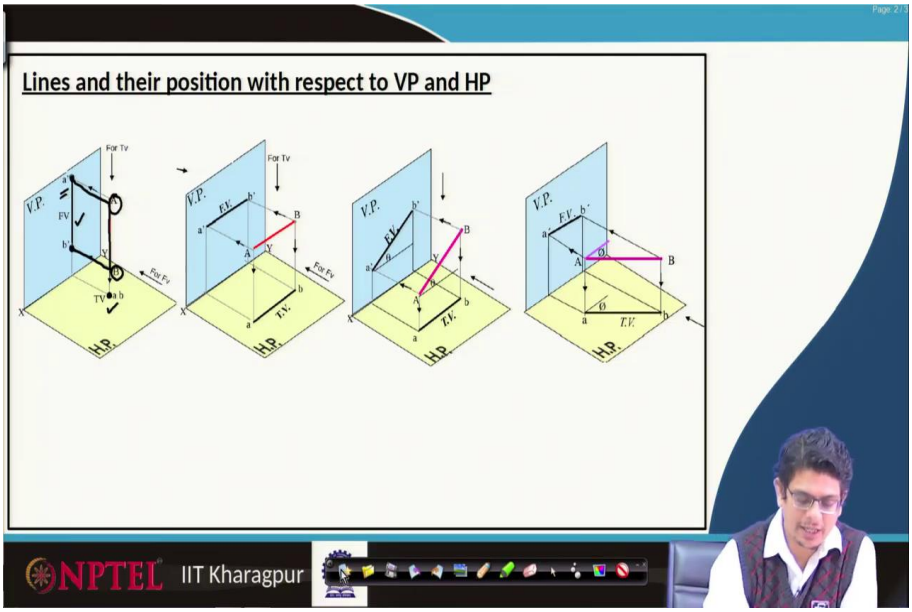

In these orthographic projections, in the last class, we have learned about different kind of projections of a line. For example, a line which is perpendicular to the horizontal plane and perpendicular to that vertical plane, how it turns out to be in terms of projections.

So, for example, one of the line if it is perpendicular to the horizontal plane. The projection of this entire line on the horizontal plane will be a dot point whereas, this projection of this line, which is

parallel to that vertical plane we will see it as a true length line. Because this A B line is the true length line.

And its projection on that vertical plane for this case becomes true length on the horizontal plane it becomes a point. And our notation is upper case letters are capital letters for true lines and projections, if it is on the horizontal plane, it will be lower case letters. If it is on the vertical plane there will be lower case letters with dash or prime.

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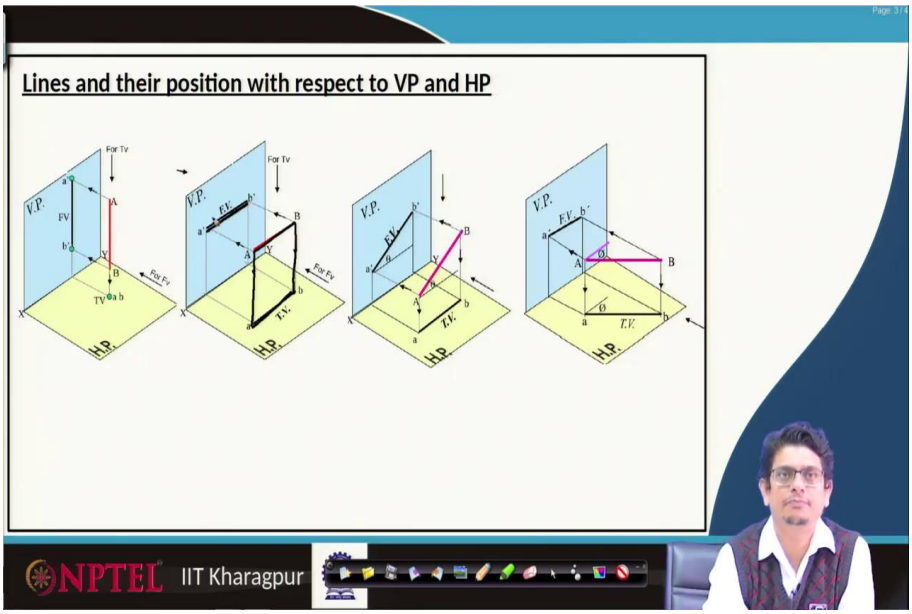

Similarly, we are trying to look at a line which is parallel to both horizontal plane and vertical plane. Then, it gives us true length both in the top view or on the horizontal plane, and also on the front view or the vertical plane.

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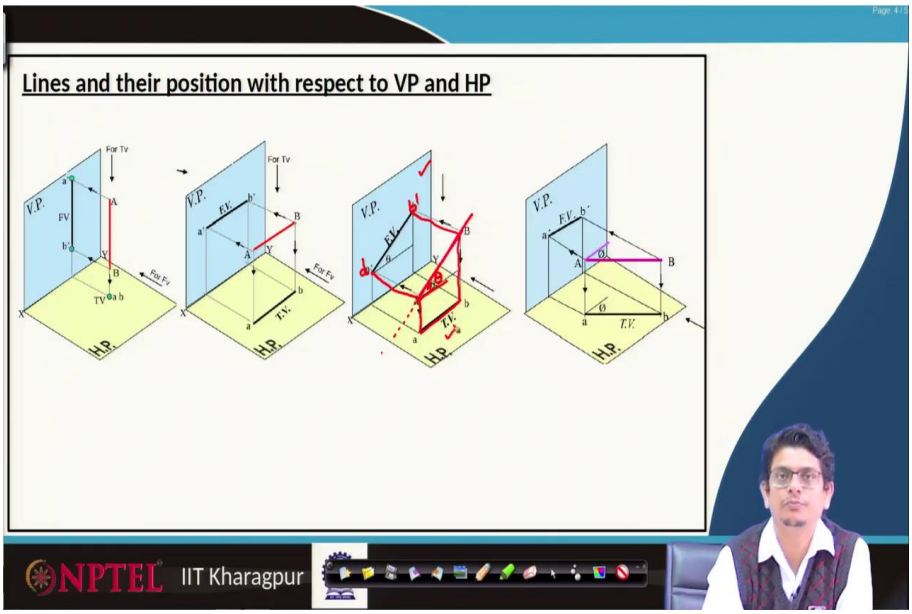

Thereafter we try to look at, a line which is making an inclination angle with the horizontal plane, if we are extending it with the horizontal plane is making an angle theta. But, this line is parallel to the vertical plane, in that case, the true length projected onto the front view, and apparent length will be projected onto this top view. And our usual notation is any line making inclination angle with the horizontal plane, we represent it by theta this is standard notation. And, if this line making an angle with the vertical plane, then we call it phi.

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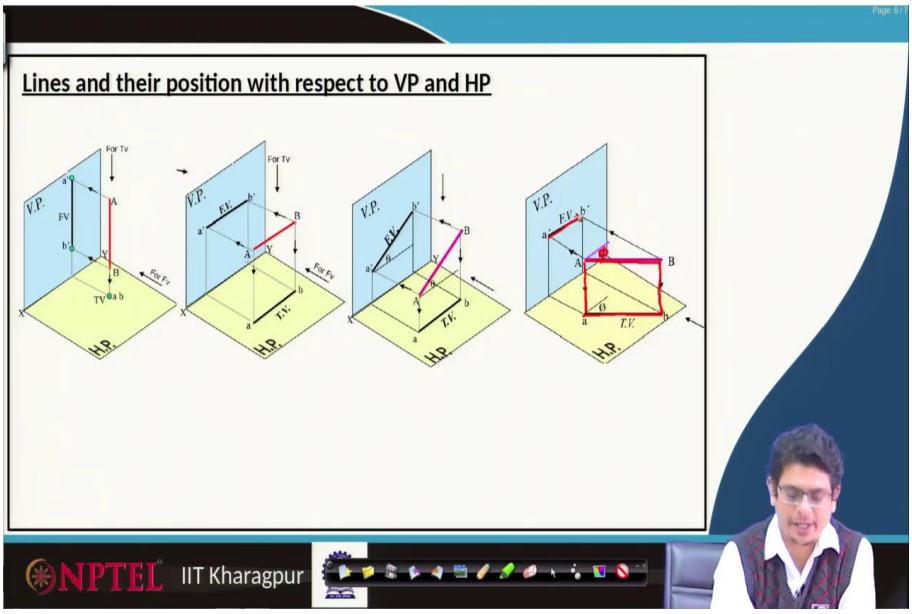

In this case a line making inclination angle with the vertical plane phi. So, true length we will get it by projecting it on the horizontal plane. Projected length, the apparent one we will see it on the vertical plane.

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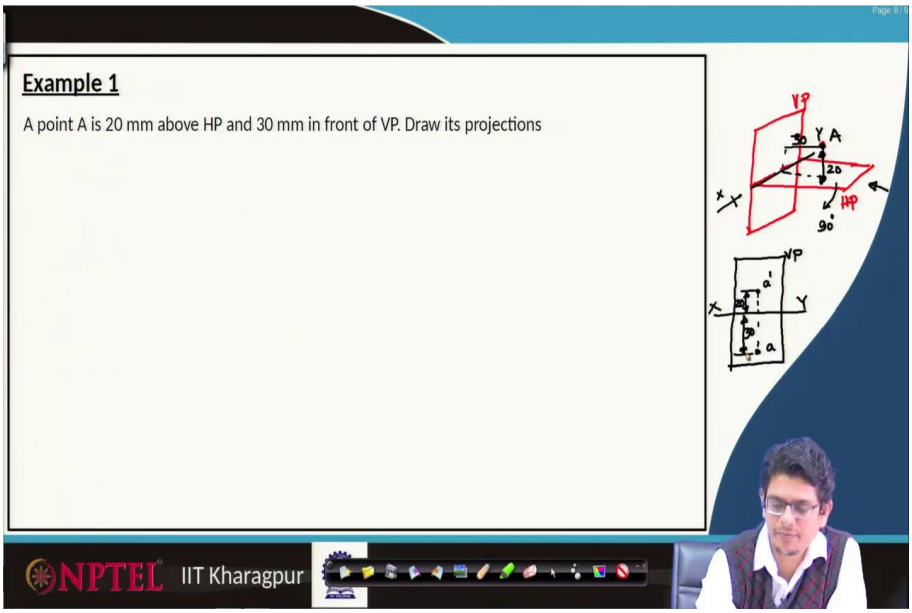

Let us begin by looking through an example the first example is a point A is 20 millimetres above the horizontal plane and 30 millimetres in front of the vertical plane, then draw its projections. So, let us consider this point A is in the first quadrant if that is the case we will be having let us consider this is the vertical plane and this is the horizontal plane. Our line if there is a point this is the point 20 metres above HP. So, let us call this one horizontal plane, and this one vertical plane, the point is this let us call A, this is 20 millimetres above HP. If we are drawing that will be 20 mm and 30 mm in front of the vertical plane. So, this might be 30 mm if that is the case, we have to draw projections. The way we do these projections is either we can look from here or we can look from the side it depends on which view we are trying to look at draw this figure.

So, the first thing always we draw a vertical plane, on this vertical plane, the projected one let us call this name it X-axis Y-axis. So, our X axis Y axis passes through this point origin. Project this point A on to vertical plane so, that note it down a' and this one, if we are having that, will be 20 mm. Because this is the length what we are going to see.

Now, project an onto that plane here, then rotate horizontal plane in the clockwise direction by 90 degrees. If we are projecting goes on to that and that will be somewhere here a. So, this length will be 30 mm this is the way we construct. Let us look at the solution.

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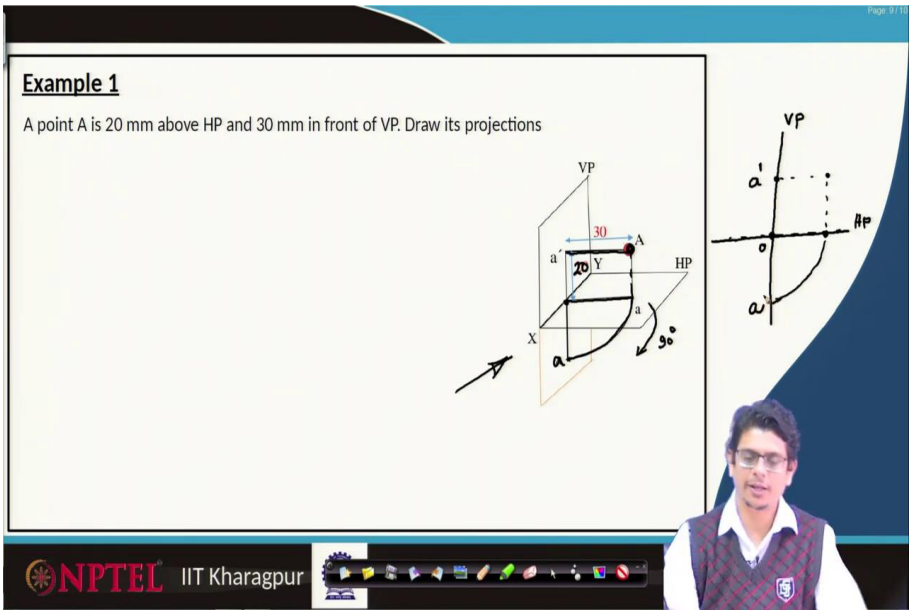

To draw the thing the easy way is we have the point A straight forward projection of 20 lengths is done. Once it is done, we project it on the horizontal plane, and then use this origin with that radius transfer it to this point, which is same as rotating this plane by 90 degrees.

So, if we are looking from this side view try to look at redrawing these projections. The way is we have this axis vertical plane. Let us consider this X Y coordinates perhaps at this location passing into that plane. So, this is a horizontal plane, point A projection let us call a' point a project, there once it is done from this O to this projection make an angle 90 degrees by transferring that radius. So, that we can get a.

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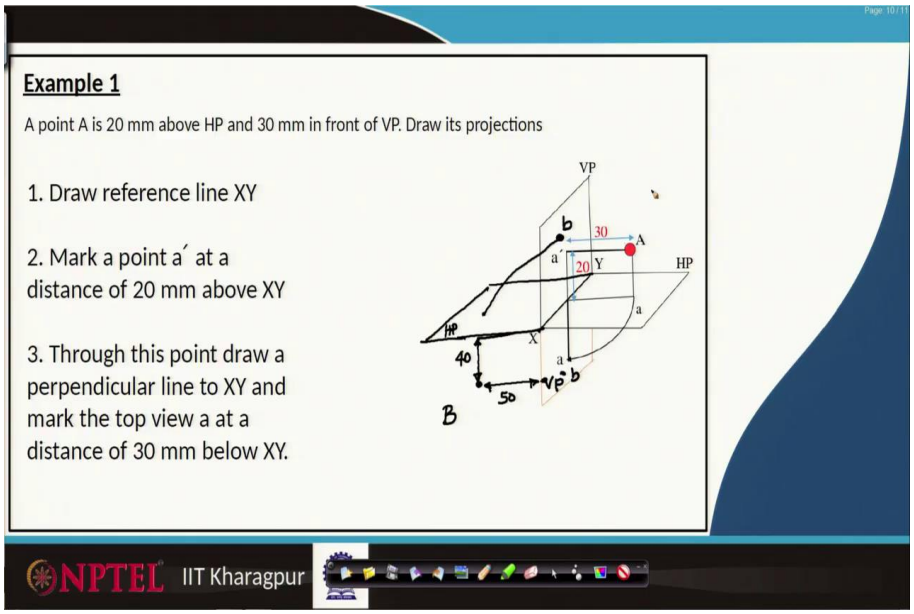

So, these steps what we have to do? Let us look at on the sheet how to construct this. First of all draw a line on the sheet, construct a horizontal plane and a vertical plane.

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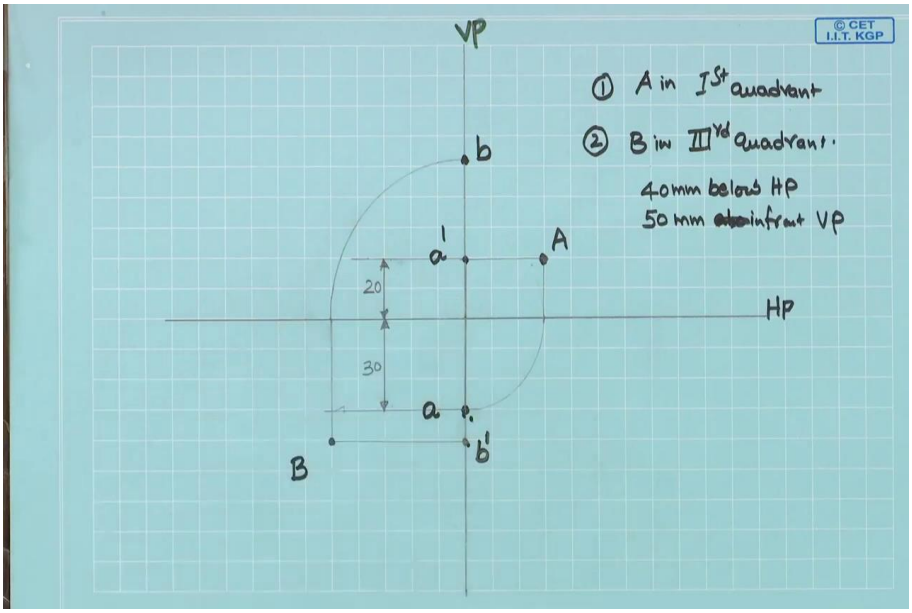

This is the vertical plane, let us use marking, this is the vertical plane and this is the horizontal plane. We have to know the first project point a, somewhere a which is 30 units 1 2 3 units. So, somewhere 10, 20, 30 here and 20 units above; that means, 1 2 units. So, this must be the point A capital A, that we have to project it onto this bottom.

First, we always project it on to the vertical plane because that is an easy thing to do. So, project here, similarly project it onto horizontal. Whatever the thing we have projected that point a' on the vertical plane. Now, use our compass to transfer this length. So, transfer this projected 1 from here to there. So, the way we transfer is by drawing an arc. Once we are done these point, we call a.

So, now darken these lines. And then this will be 20 units and this will be 30 units. This is the way we project a point in the first quadrant. Let us ask a question if the same point a perhaps if it is in the third quadrant. How to draw these projections?

Let us look at an example the first problem is a in the first quadrant. The second question what we are going to ask? There is a point B in the third quadrant, which is something like 40 mm below the horizontal plane, 50 mm above in front of the vertical plane is more like asking a question. If we are having this third quadrant also somewhere the point B is present, which is 40 mm below the horizontal plane, because this is the horizontal plane below that 40 mm.

And in front of the vertical plane, this is the vertical plane, in front or backside the way how we look at it. So, that is 50 mm if this one is 50 mm., what will be the projection of this point B, on the vertical plane horizontal plane. Further purpose what we have to do recall our last thing?

We have to project this point straight away onto vertical plane always somewhere it goes below, but the horizontal thing the way how we do it for the third quadrant, always be clockwise 90 degrees we have to do. So, first of all, project there and then transfer it by radius rotating it there. So, there we will have this b, there we will have b, it comes to top and bottom switches.

So, let us look at that problem so, b point is 40 mm below and 50 mm in front of the vertical plane. So, 50 mm is this one and 40 mm 0 10 20 30 40 somewhere here. So, our point b let us call it's in the third quadrant there.

Now, we have to project that so, our point b comes to this location. This is what we call b'? On the horizontal plane, we first project it into the horizontal plane, then make an arc rotate this point by 90 degrees. Once we rotate this point moves on to this point b and this one b'. If the point is A in the first quadrant is the top view will be at the bottom is the front view on the top. So, with respect to this point, we always say whether it is at the bottom or with a top.

If it is in the third quadrant they will flip. So, what you are going to have is a top view a top front view as it is, that is the way we have to draw the things. If it is in the second quadrant again, we project that, if it is in the second quadrant, we will straight away project this point on to the vertical plane, horizontal plane project it then rotates it 90 degrees it comes up.

If it is the fourth quadrant there also first the point projected onto a vertical plane somewhere here, then project it on to horizontal plane rotate it by 90 degrees clockwise. There is a way we construct this front view and top view of a point on a plane.

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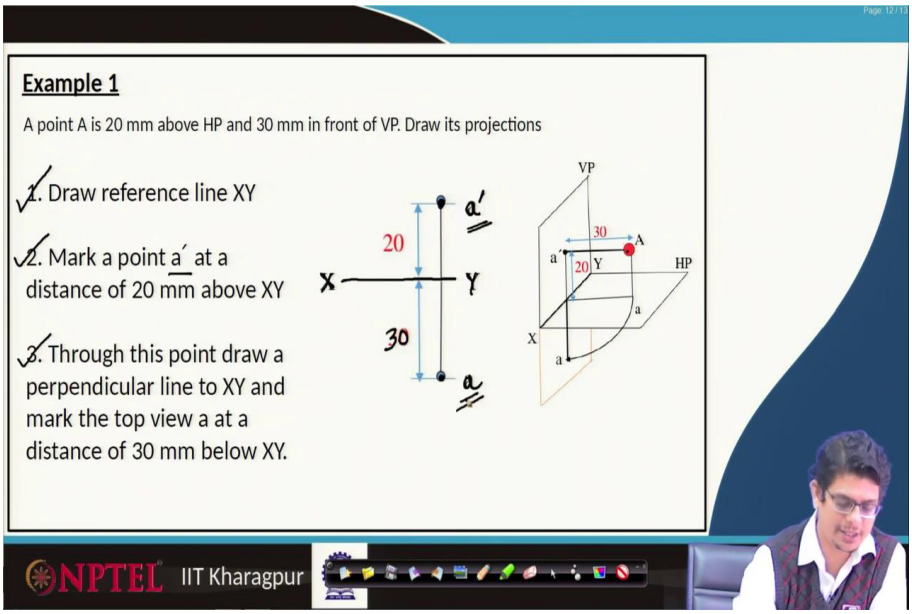

Let us look at the solution you see there when the point is in the first quadrant. What we have is? a' at the top level and a is at the bottom, this is the front view and this is a top view for a point in the first quadrant.

The steps what we have followed is? First of all, one has to draw a reference line XY this is the XY line, then mark a point a' at a distance 20 mm above XY point a, we projected on to vertical plane 20 mm. So, at 20 mm height, we mark a' above XY we are in the first quadrant. Then through this point draw a perpendicular line to XY and mark the top view at a at a distance 30 mm below it. Once we are done this a' is the front view a is the top view we will get.

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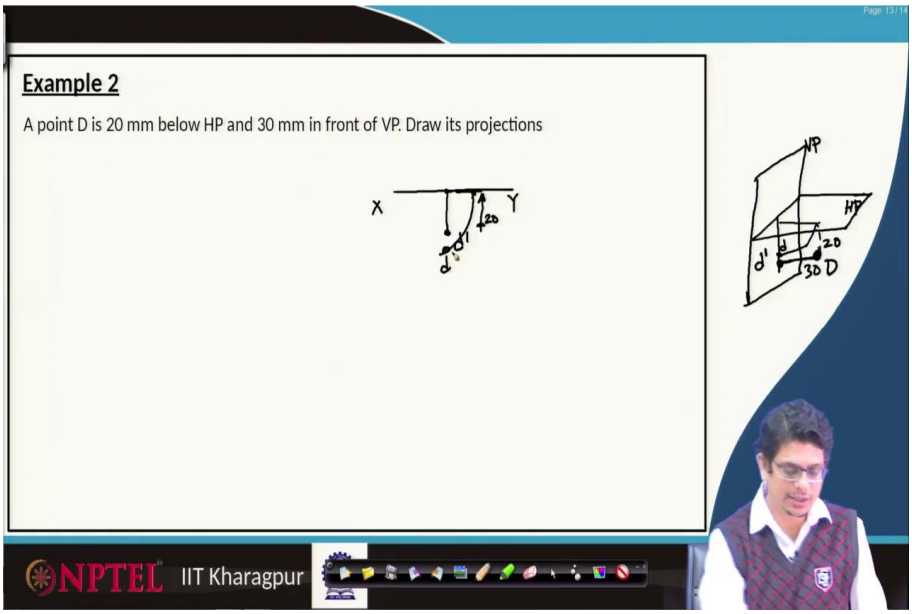

Now, let us ask the next question. A point D is 20 mm below the horizontal plane and 30 mm in front of the vertical plane draw its projections. Can you guess how to draw this point, to visualize that first of all we have to construct a schematic like, this is the vertical plane and this is the horizontal plane?

There is a point D 20 mm below horizontal plane; horizontal plane, vertical plane 20 mm below means somewhere here and 30 mm in front of vertical. So, 20 mm go down, somewhere there and it is 30 mm in front of VP. So, if I am measuring from the vertical plane this will be 30 if we are measuring from the horizontal plane that will be 20.

So, your point D is at fourth quadrant though we would like to draw projections from the first quadrant thing, the point itself is in the fourth quadrant. That we have to represent by first angle projection technique. If that is the case what we are going to do the project this point on to the vertical plane, somewhere there we will get d'. Project D on to the horizontal plane, then use this radius transfer that down. So, that point D we will have.

So, from reference line this is the way it is supposed to look like; that means, if we are drawing a projection is supposed to be first draw XY line locate d' below it at a distance of 30 mm at a distance of from horizontal plane it is 20 mm so, locate 20 mm down. Then project this one on to top one 30 distance we will have. So, from origin make something like 30 mm somewhere here, then transfer that by radius. So, this will be d.

So, let us look at the solution on our drawing sheet. So, first of all, we have to draw XY line, name it, X-axis, Y-axis somewhere origin pick it O. Now draw a perpendicular line. On this perpendicular line what we have to do point d is 20 mm below horizontal plane; that means if we are projecting that 20 mm onto the vertical plane at a 20 mm distance, we will mark this front view. So, 20 mm, this is the point where we will have d' because of its a projection.

And this point 30 mm in front of VP. So, 30 mm project somewhere there, but we want to transfer that in the first angle projection; that means, take radius mark this point transfer it by the arc. If we are doing that it cuts their name that point d.

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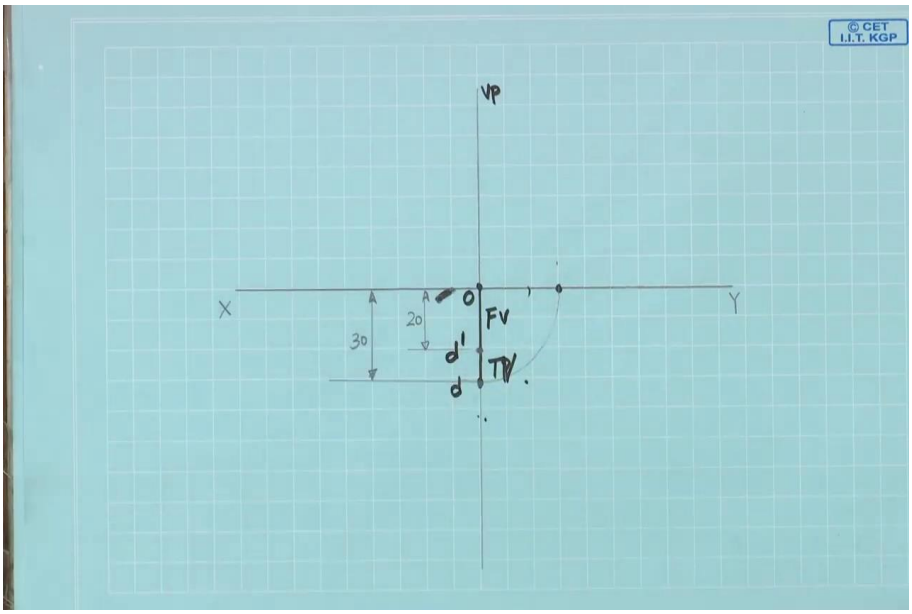

So, let us look at the solution on our drawing sheet. So, first of all we have to draw XY line, name it X axis, Y axis somewhere origin pick it o. Now, draw a perpendicular line. On this perpendicular line what we have to do? Point d is 20 mm below horizontal plane; that means, if we are projecting that 20 mm onto vertical plane at a 20 mm distance, we will mark this front view. So, 20 mm so, this is the point where we will have d dash because its a projection.

And this point 30 mm in front of VP. So, 30 mm project somewhere there, but we want to transfer that in the first angle projection; that means, take radius mark this point transfer it by arc. If we are doing that it makes a cut their name that point d.

Now, the front view will be this one front view and this one top view, top view of this length what we are going to see, all the way from origin to d point and front view will be from origin to d'. This is the origin let us call.

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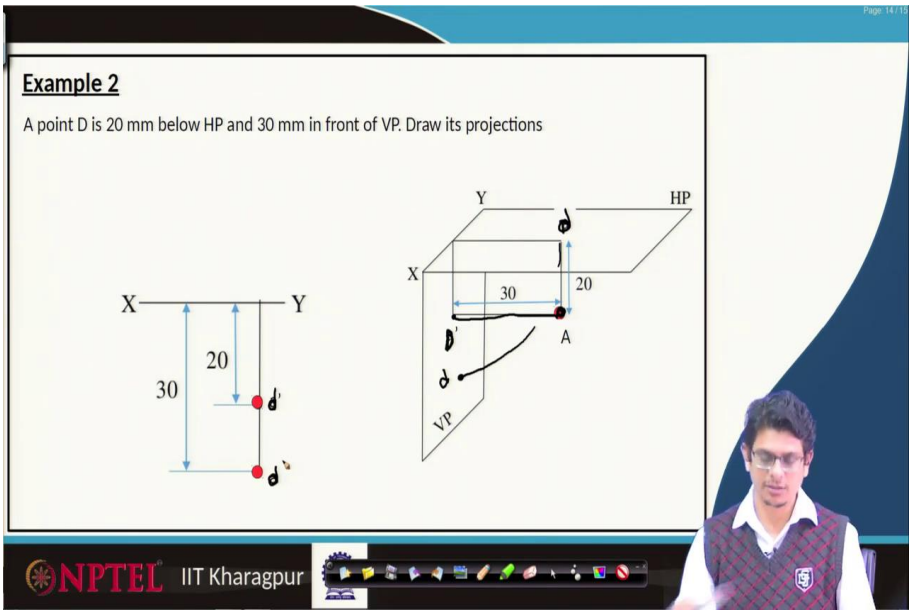

Let us look at the solution. So, as I mentioned point here projects that straight away to a' D' this supposed to be D' and this is d small d. So, projected one we will have it by rotation to this point. So, this I am sorry this supposed to be d' and d.

So, let us look back our solution on the drawing sheet. Here we just have to mark the dimensions like this line will be 30 mm. So, you use by arrows double arrows and this will be 20 mm.

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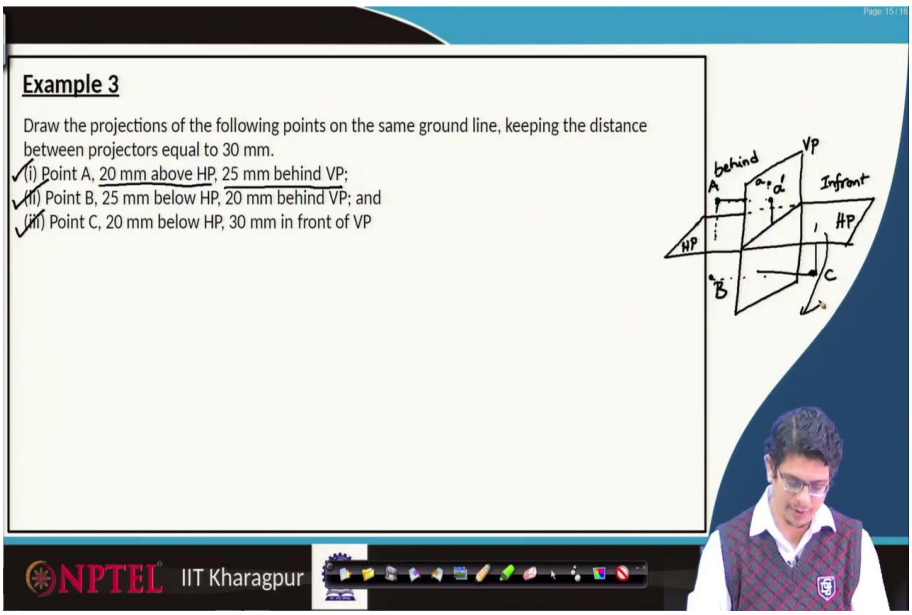

Let us move on to the new example. Let us ask a question there is a point A which is 20 millimetres above the horizontal plane. Let us pick part 1, there are three parts the first part is there is a point A

20 mm above horizontal plane and 25 mm behind the vertical plane. If that is the case, can we draw projections of this point A? Further first what we have to do is visualize that, by making a vertical plane perhaps that might be the horizontal plane.

Now, what we have is point A? 20 millimetres above the horizontal plane above 20 it can be here it can be there, but it is 25 millimetres behind the vertical plane. So, in front of the vertical plane is this is let us make it in front and this is behind. If that is the case point a will be somewhere here, let us call point a which is 25 millimetres behind VP and 20 millimetres above HP. What we have to do is? Get the front view and top view of this point using the first angle projection technique. Further, what we have to do is? Always project this point a straight away on to vertical plane note down that point as a'.

Then, project this point A on to the horizontal plane, then rotate it by 90 degrees. So, rotate the horizontal plane by 90 degrees to mark that point A. Because this distance is 20 from behind 25 VP so, point A comes up. Because 25 mm we are transferring it on the top direction and 20 is this. So, the 25 point when we are rotating it by 90 degrees it always goes up.

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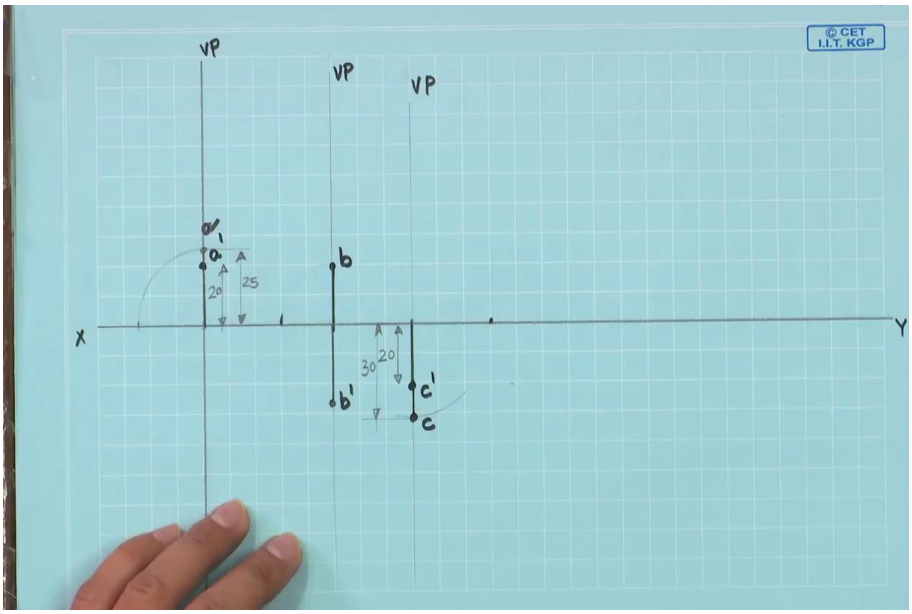

So, let us draw it on the sheet something may be, let us draw a vertical plane in that way. Name it this is a vertical plane this is x-axis y-axis and first thing, what we have to do is project this point a in front of the vertical plane by 20 mm. So, 20 mm somewhere there this is let us call a'.

And 25 mm behind VP maybe this point, transfer that point somewhere there. let us call that point a. The dimensioning always be required and what we can do is on this side, let us make it this supposed to be vertical lines 25 and this will be 20 that is the first part.

Let us move on to the second part at the second part point B 25 mm below HP and 20 mm behind VP. So, behind VP is here below is this. So, point B must be somewhere there, then project first of all this point B on to the vertical plane. So, for that purpose What we have to do is? Is below is 25 mm. So, leave some gap and if you are looking at this sheet minimum 30 mm gap has to be given for any construction.

The projector C if that is the case from projector 30 mm I have to give and go ahead construct this below 25 mm. So, somewhere here below 25 mm mark a point, call this one b' connect these lines, this is the front view this is the top view b' is done.

Then behind VP 20 mm so, located behind 20 mm somewhere there. Because this third quadrant and what we want to project is project this point B onto the horizontal plane rotate it. If we are doing that it will be somewhere projecting it 90 degrees. So, a point will be somewhere there. So, let us join that point and let us call b. The third point C 20 mm below HP and 30 mm in front of VP. So, point C, first of all, locate somewhere below, but in front of VP means here. So, the C point is somewhere there.

So, how we will construct? Project this C point onto that project that and rotate this horizontal plane by 90 degrees. To do that what we have to do? Again leave 30 mm gap between the projectors somewhere there, on this line, we will have these projections name it as vertical plane 20 mm below HP. So, mark a point join that name that point as c' and 30 mm in front of VP.

So, in front of the vertical plane which we can note it here also, if this is the vertical plane in front of that 30 mm and rotate these 90 degrees. On to that plane then we will have c point also. Once it is done, we can always make dimensions this one 20 mm below. And this one 30 mm. This is the way we construct projections of lines, check our solution both the points a' a on one side above that XY line.

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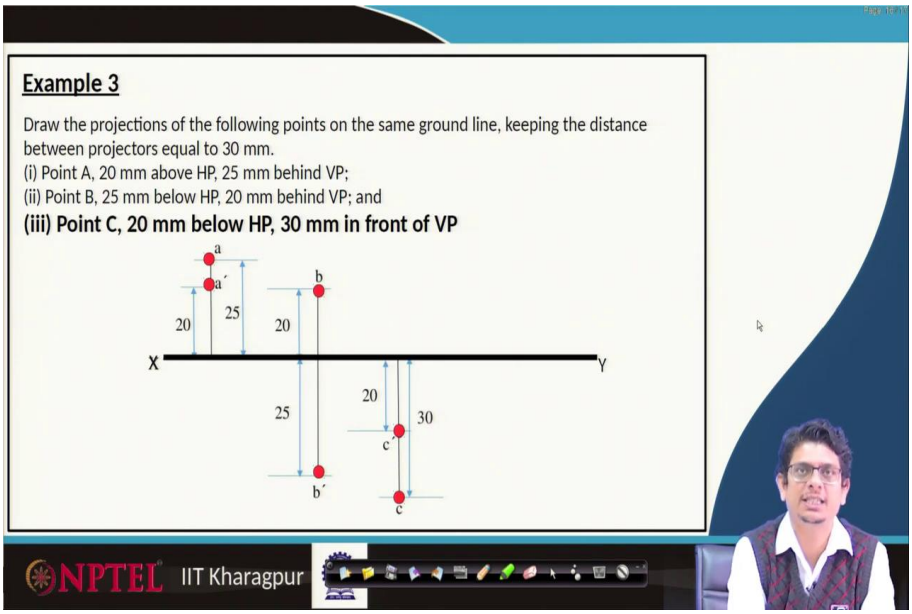

If point B is 25 mm below horizontal plane 20 mm behind VP, the solution will be b and b' will be on the opposite sides. Similarly, for point c below HP in front of VP both the points on one side, but that is below the XY line, check your solution with the actual solution ok. In the next class, we will learn more about these projection techniques.

Thank you very much.