Engineering Drawing and Computer Graphics
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Module – 03
Lecture – 30
Orthographic Projections I (Part -10)

Hello all, welcome to our NPTEL Online Certification Courses on Engineering Drawing and Computer Graphics. We are in module number 3, lecture number 30. And, we are covering Orthographic Projections I.

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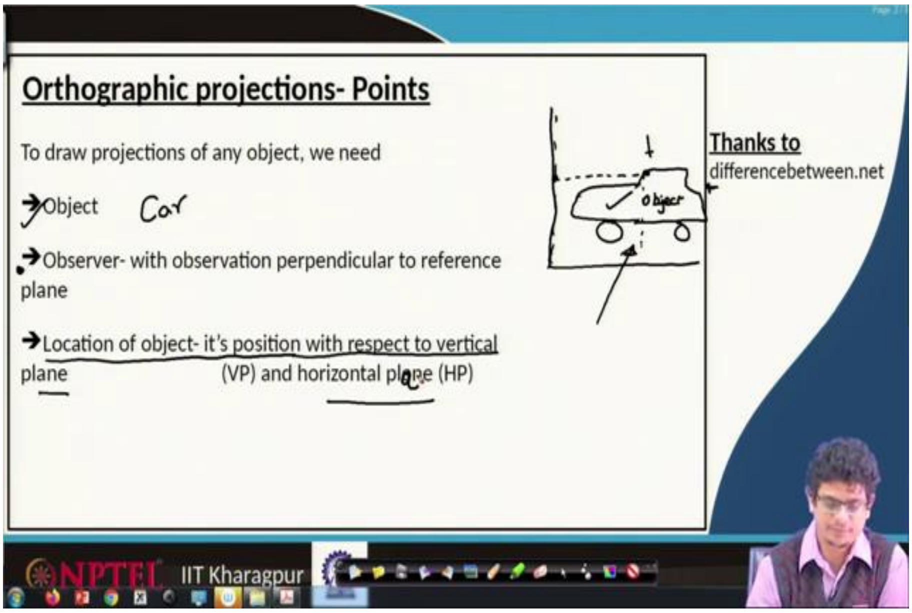

So, in these orthographic projections I, we are covering the last topic on points and point projections. The first question what we would like to ask is how to draw a projection of any object especially a point. For that purpose, what we require is we require an object perhaps it can be a camera, it can be a pen, it can be a pencil, or it can be a car also. So, each point on that surface of the object we are going to project it onto a reference plane.

So, the things what we require is an object, let us say a car and we require an observer, with an observation perpendicular to reference planes; that means if this is the car. Any point the object this is the object any point on the object we are projecting on to a reference plane. Similarly, we might be projecting the top one onto that bottom plane.

So, first, one objects this is the second one is observer, we are the ones who are looking at it either from the top view, side view, or front view, in that direction. That is what we call the location of objects is a position with respect to the vertical plane and horizontal plane. I think this should be a plane. These are the three things what we require for any projection.

Because projections are the ones which give us true dimensions of that object.

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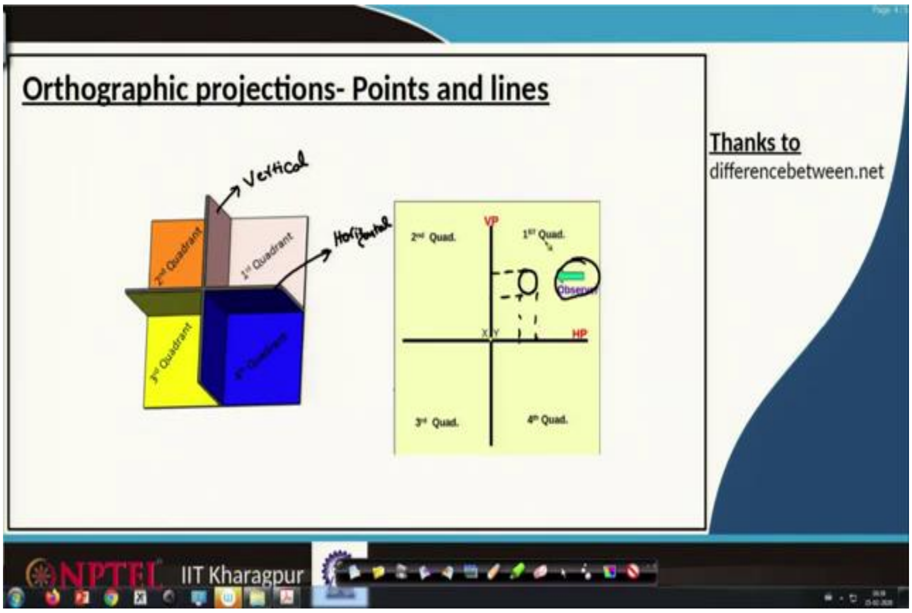

In the last classes, we have learned about different kind of quadrants an object located, in the 1st quadrant, 2nd quadrant, 3ird quadrant, and 4th quadrant. In these quadrants, we call this one as the vertical plane.

If an object is placed in that 1st quadrant, this object the kind of projection what it maps onto that plane, what we have called this reference plane? And, this plane what we called a horizontal plane. And, based on the observer for example, observer if an object is present there, the projection on to that surface, what we are going to see as the things on this vertical plane and horizontal plane?

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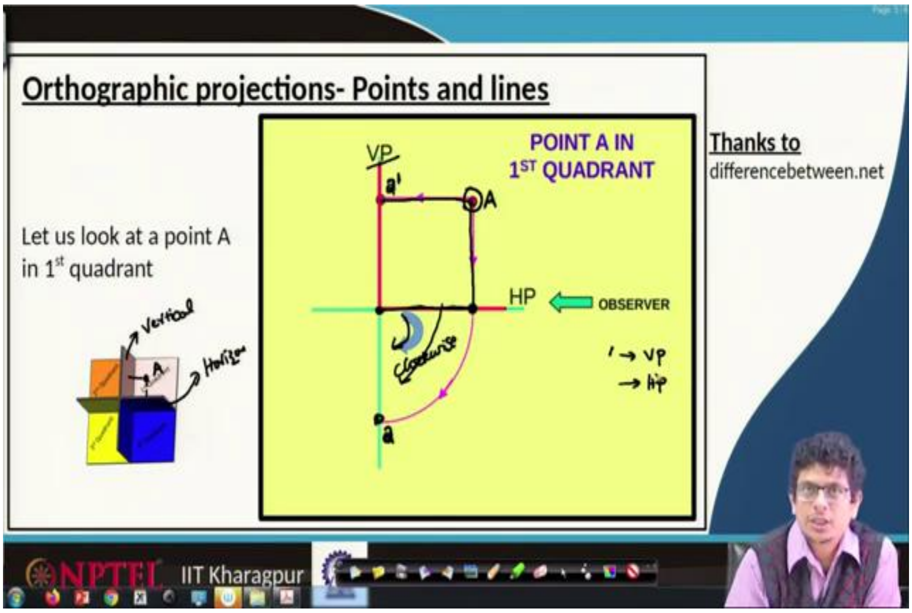

Based on these planes, when we are folding, unfolding, this vertical plane, horizontal plane, we will have this mapping of point differently on these different planes. For example, let us consider a point which is projecting on the plane.

For example, point A we are interested in having a projection. Though it is placed in quadrant A this point, the projections what we are going to see is on this vertical plane and on that horizontal plane. So, here point A projected onto a vertical plane, this is the vertical plane. And, the notation for our engineering drawing is any projection onto the vertical plane, we use this' or'.

And, lower case let us indicates the projection things orthographic projections and uppercase letters are the true object thing. So, because we have projected onto vertical plane small a'. Similarly, this A projection onto that horizontal plane and unfolding this horizontal plane by 90 degrees in the clockwise direction.

So, project that and based on this origin transfer this length or radius in this direction to get point a. On horizontal planes that is this horizontal plane unfolded we show it by lower case letters without any' or's. So, the terminology is a' for projection onto the vertical plane without' onto the horizontal plane. This is for a point projected in the 1st quadrant.

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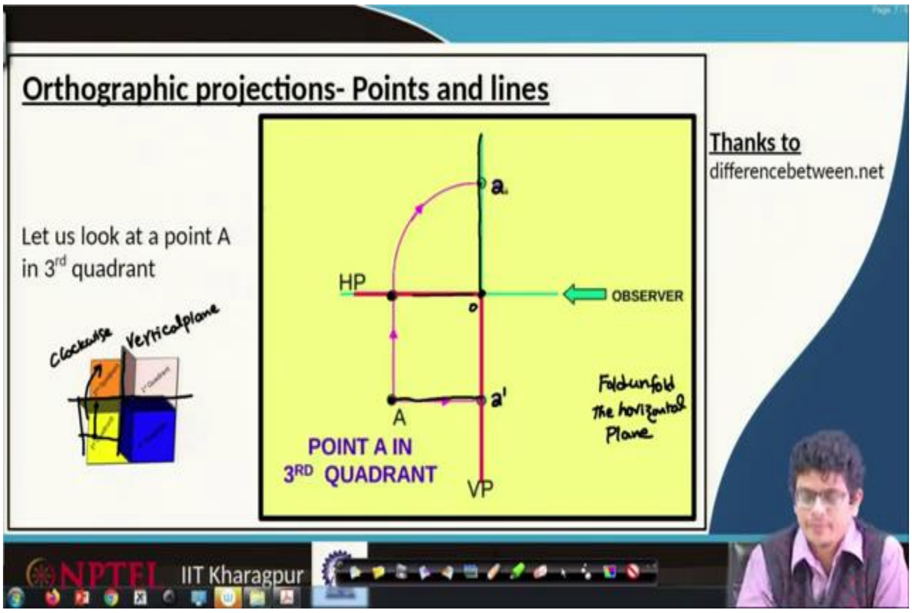

Let us look at a point in 3rd quadrant if it is projected onto these planes vertical plane and horizontal plane how it looks like. Now the point A it is in 3rd quadrant; that means, in this third quadrant somewhere point A is located. And, we are interested in the projection of this point A onto different planes.

What we have seen is in the 3rd quadrant, it will be mainly projected onto that opaque plane and we are making that opaque plane, in the clockwise direction by 90 degrees. So, this point on to the parallel vertical plane, this is the parallel vertical plane projected onto that and this entire plane the mirror, we are making it 90 degrees rotation in this direction to make it a vertical plane. That, what we can see here?

The point A projected onto this vertical plane. So, A point we want to project it onto that vertical plane. And, what we are going to do is always, fold unfold the horizontal planes. So, if we are projecting on the parallel planes either here or on this vertical plane, the projection that gives us a'.

Now, this one projected onto a horizontal plane that is this. Once we have that projection we unfold this horizontal plane by 90 degrees in the clockwise direction. So, that this entire horizontal plane comes at this top-level; that means, our point with this one as origin, this one as the radius, transfer this radius onto that plane name it lower case letter a.

And, let us look at it again. Once we have this point A, we have to project this point on 2 corresponding planes always we project it on to vertical plane first once it is done we name it a', A point to a'.

This point we project it on to the horizontal plane and the horizontal plane is made into 90 degrees clockwise direction. So, this one we are going to flip it so, that we can construct this one as the horizontal plane and transfer this projector length in that way and call that one a.

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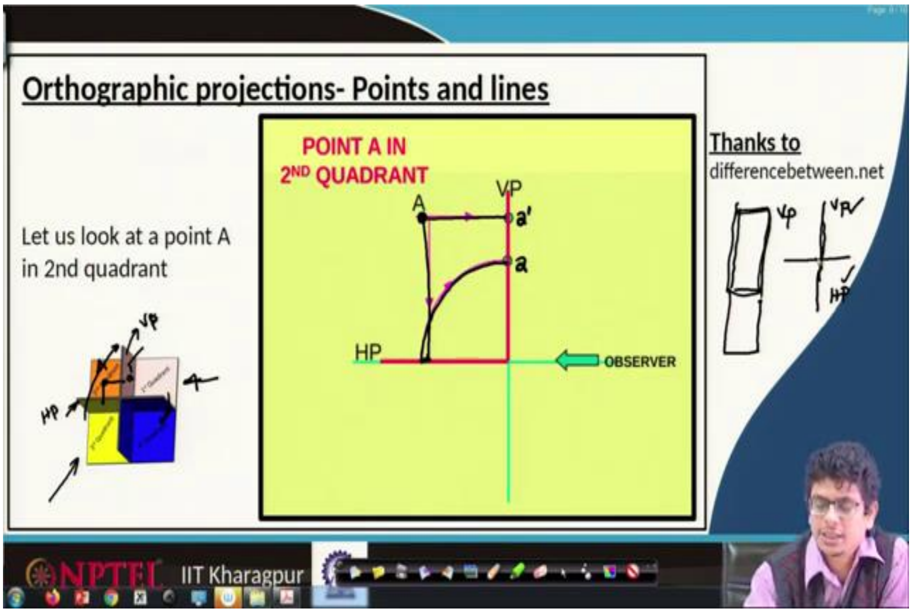

Let us look at if a point is in the 2nd quadrant; that means, the point is somewhere here A. First thing we have to project this point onto the vertical plane is this one, let us call this one this is a horizontal plane. Project point A on to the vertical plane and whatever that impression creates that is a' that is point A is there project that calls a'.

Now, project this one on to this bottom side and fold this by 90 degrees clockwise. So, this horizontal thing whatever we have projected that we are uncovering in that direction. So, that will be located. In most of the cases, this plane projections points line and other things either we show it on the plane. So, for example, if I am showing 1st quadrant plane, vertical plane; maybe we might be showing like the vertical plane, horizontal plane. If we are looking normal to that plane, normal to vertical plane and unfolding it or if we are looking on to this sideways; sideways of that will be this is the vertical plane, horizontal plane by flipping 90 degrees we will have this line. So, here we will have a horizontal plane.

. So, if we are going to construct any 2-dimensional things. We do not show this entire object the projections we will show it on the vertical plane, on the horizontal plane. In one view this makes a box, in another view, it makes like a line.

So, on these lines or these planes, we are going to show the projections. And, what we are trying to look at is all the time this vertical plane remains the same, but horizontal plane perhaps flipped by 90 degrees in the clockwise direction. So, we show that impression if it is 1st quadrant in that way.

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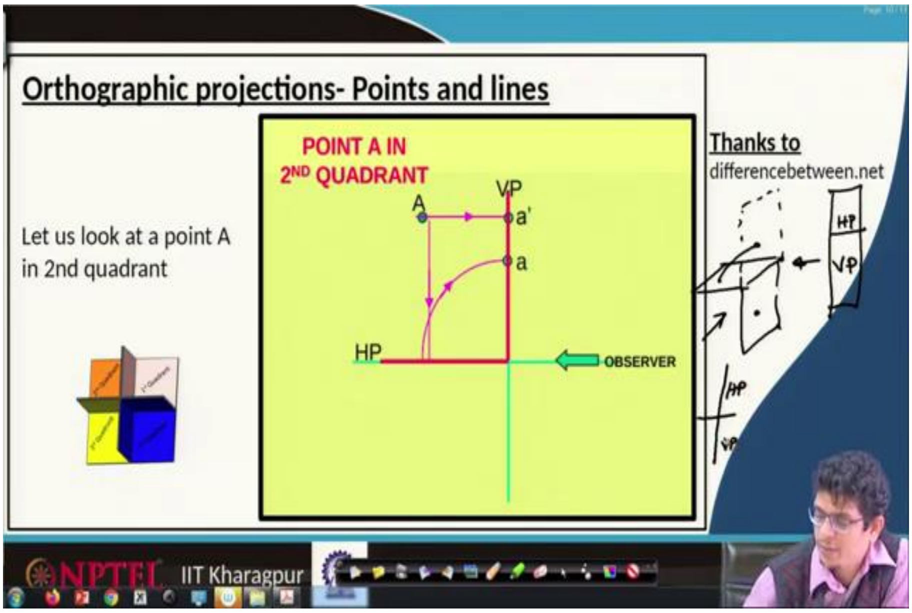

If it is in 3rd quadrant; the 3rd quadrant plane vertical plane remains the same, but the horizontal plane is that and what we do is? Keep the vertical plane remain same, the projection we always have that and the projection we flip it into 90 degrees clockwise transfer that radially. So, we will have an impression.

If we are looking from this view this makes like a horizontal plane there, vertical plane there, if we are looking from this direction it looks like a line top one is a horizontal plane, the bottom one is a vertical plane.

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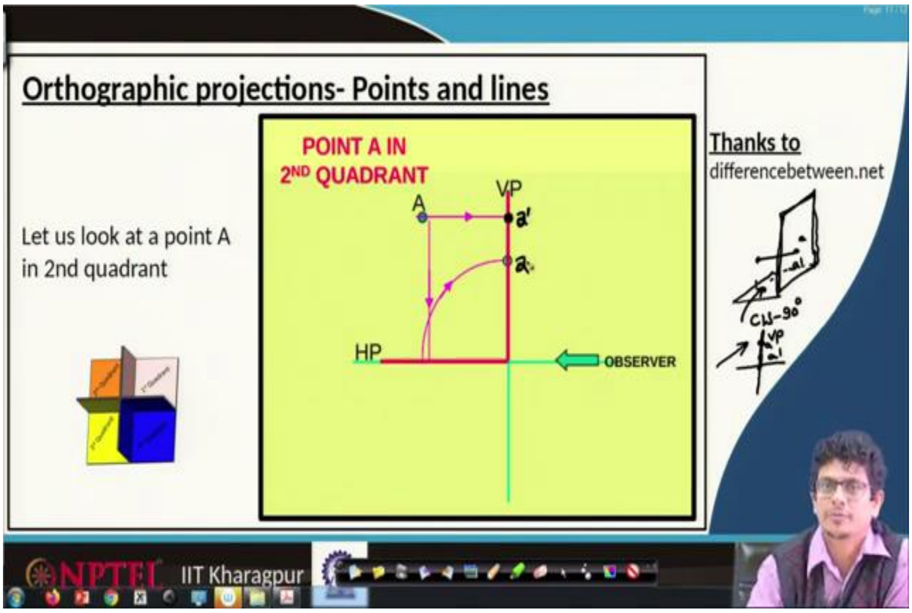

Similarly, if we are in 2nd quadrant for example, here, if we are in 2nd quadrant, vertical plane projection always we keep it there, horizontal projections we might be having it in that way. Always we rotate any horizontal plane in the clockwise direction by 90 degrees. If, we are doing that both the planes coincide and we have to transfer this one let us call a’ and a.

If we are looking from this view it will be a line and this line, this is vertical plane horizontal plane also here, and one of the projections is here another projection is a’. That is the thing what we are seeing a’ as the vertical projection, an as the horizontal projection.

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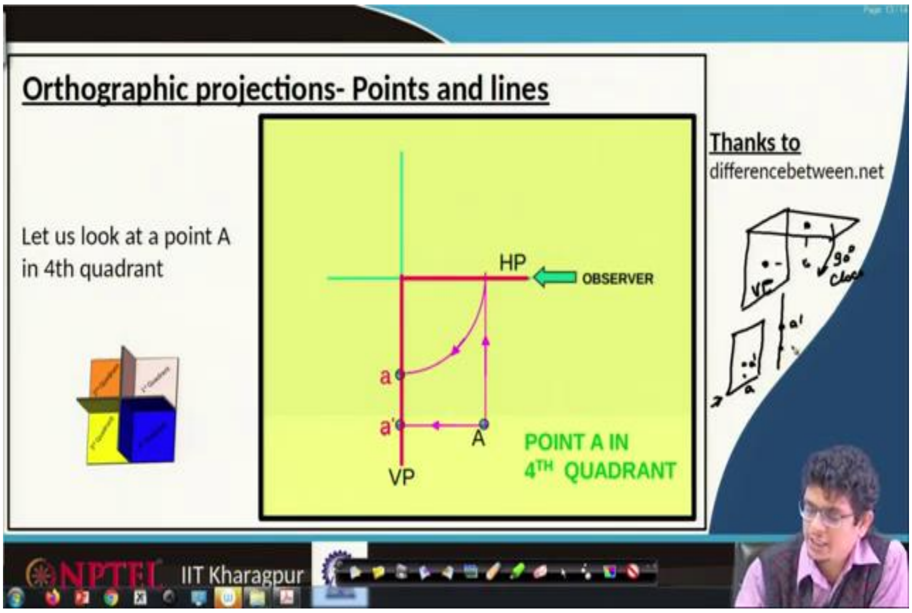

Let us apply the same rule for the point in 4th quadrant. If it is the 4th quadrant this is one plane, this is the one the point projected onto the vertical plane. The vertical plane remains the same on to a horizontal plane we are projecting, rotate this horizontal by 90 degrees and clockwise.

If we are making they will coincide one of the projections a’, the other projection a. That is the thing if we are looking from this side one is a’ other one is a. So, here the point A projected on to a vertical plane is a’, projected onto the horizontal plane from their origin rotate it by 90 degrees in the clockwise to get a projection of a.

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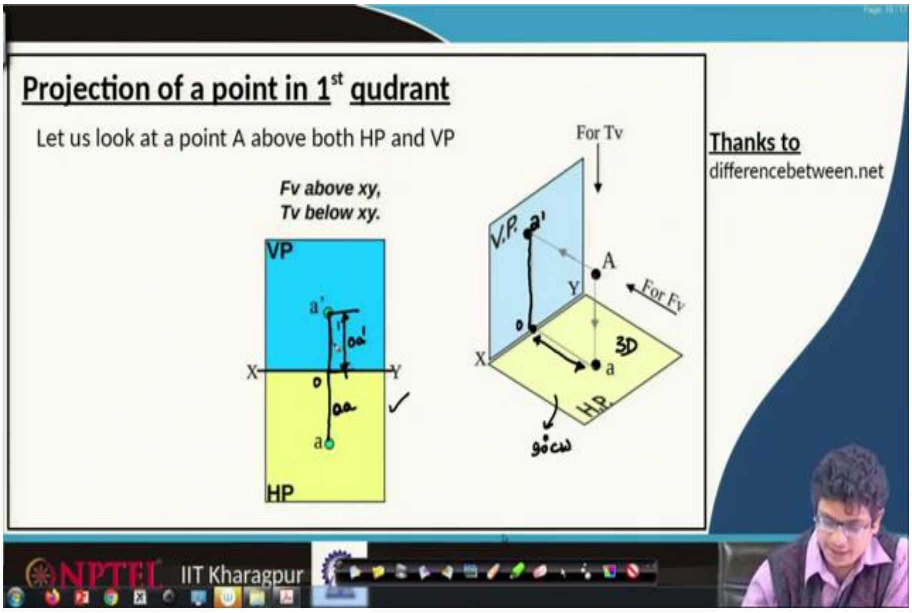

So, let us look at these projections of points on different quadrants. Especially, in the 1st quadrant, if point A is above both horizontal plane and vertical plane. So, to summarize that any point you pick it A which is above both horizontal plane and vertical plane. So, it is above A above horizontal plane and next to this vertical plane above that, if that is kind of projection if we are going to have it, then the first projection always be towards the vertical plane.

. So, we will denote that one as a’, the horizontal projection we will have a to show that we flip it 90 degrees if we do that it looks like this. So, this projection a’ is this one. So, this length o a’ same as o a’ here. Flip this by 90 degrees clockwise this distance on that plane remains the same as o an o a distance.

It is always convenient to show it in this 2-dimensional framework instead of showing this 3 D picture. Where we will have a clear indication of lengths, ah that is the reason why we use this kind of projections? Showing 3 D objects and having dimensions is always be a difficult task finding them.

So, if we are projecting these points onto these different planes, it becomes easy for us to measure the distances and reproduce those things.

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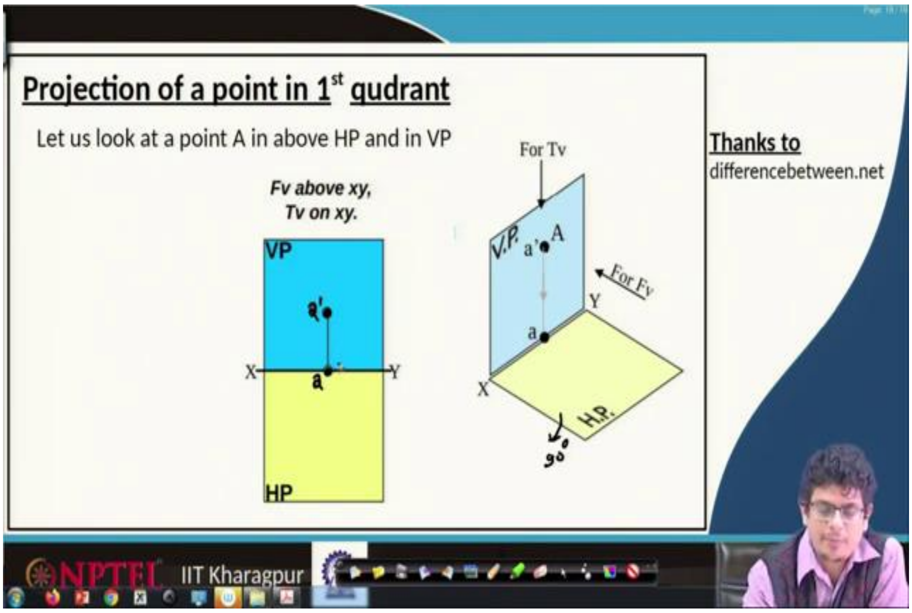

Let us look at if a point A above horizontal plane, but it is on the vertical plane. For example, let us pick point A, it is above the horizontal plane, but it is on a vertical plane, it is not here somewhere, but it is precisely on that vertical plane.

If that is the case the projections A is already there by definition it becomes a’ the projection itself. And, if we are projecting a down, it maps on the horizontal plane at o; that means if we are looking at the 2-dimensional framework, where we are going to make these 90 degrees clockwise for the horizontal plane, the’ on the vertical plane we will see.

Its projection A projection on horizontal plane precisely maps at o. So, the projection length on the horizontal plane is 0 whereas, on the vertical plane it is o a’.

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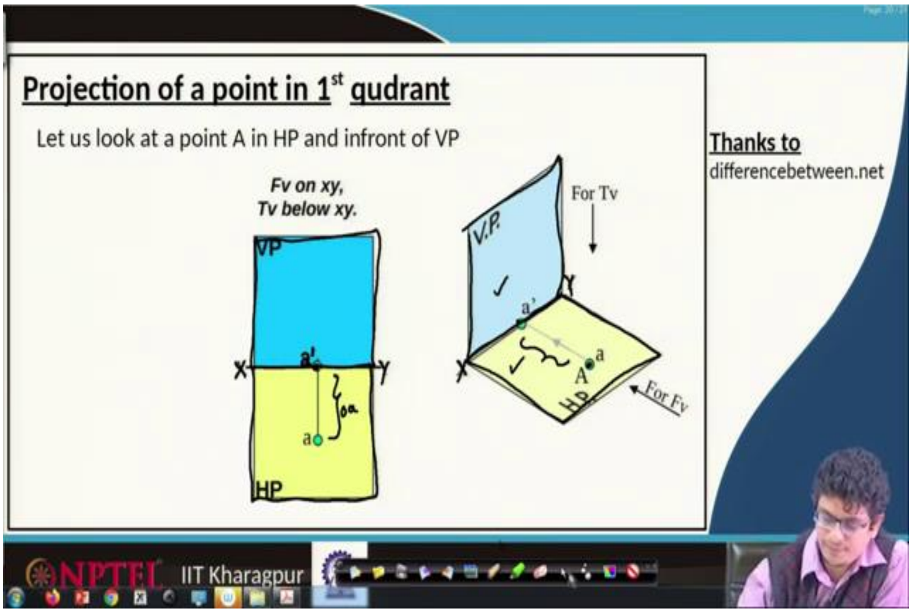

Let us ask the next question. If, point A is on the horizontal plane and it is in front of the vertical plane. So, this is the vertical plane, what we are referring to? And, the point A is on the horizontal plane in front of the vertical plane. So, if we are projecting first projection always be on to the vertical plane. It maps to origin o, that is what we call a'.

Now, projection of a capital A on to horizontal plane gives us this distance. So, if we are flipping this plane horizontal plane by 90 degrees clockwise, we will get this vertical plane, like this and this horizontal by 90 degrees clockwise that a projected onto origin. So, a' itself is the origin on this X Y plane. X Y is the axis which is intersecting both vertical and horizontal plane.

So, on that XY we will have a' precisely mapped at origin and a there is a distance, that is o a. If a point is on the horizontal plane, you will find this true lens on the horizontal plane and the projection always gives you 0.

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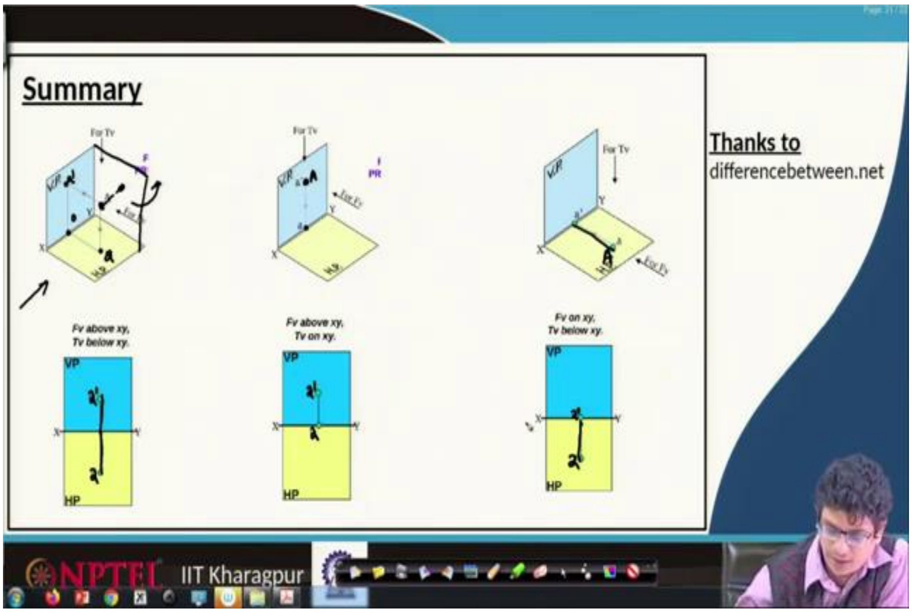

Let us summarize, this projection of a point on different planes. For example, a point which is in front of the vertical plane above the horizontal plane gives a projection on the vertical plane a’ o a and o a’ on the horizontal plane. So, o an on the horizontal plane o a’ on the vertical plane.

What about if I am looking side view projection for this point for the same configuration? The standard notation for 1st quadrant definition is first constructed this side plane project that. And, flip it in the counter-clockwise direction. If, that is the case we may be having it possibly somewhere here around. But, usually, we go with these 2-dimensional projections like on the vertical plane, horizontal plane. So, it will be in this way.

Similarly, if we are looking a point precisely on the horizontal plane, above that vertical plane, on the vertical plane above the horizontal plane; that means, this point. Then, it is projection gives us a’ on the vertical plane on the horizontal plane at 0 location.

If, point A is on the horizontal plane in front of the vertical plane o a’ will be this o a and o a’ will be mapped at o a o o location. So, we will have that 0 lengths. This is the way, point projections happen.

For example,

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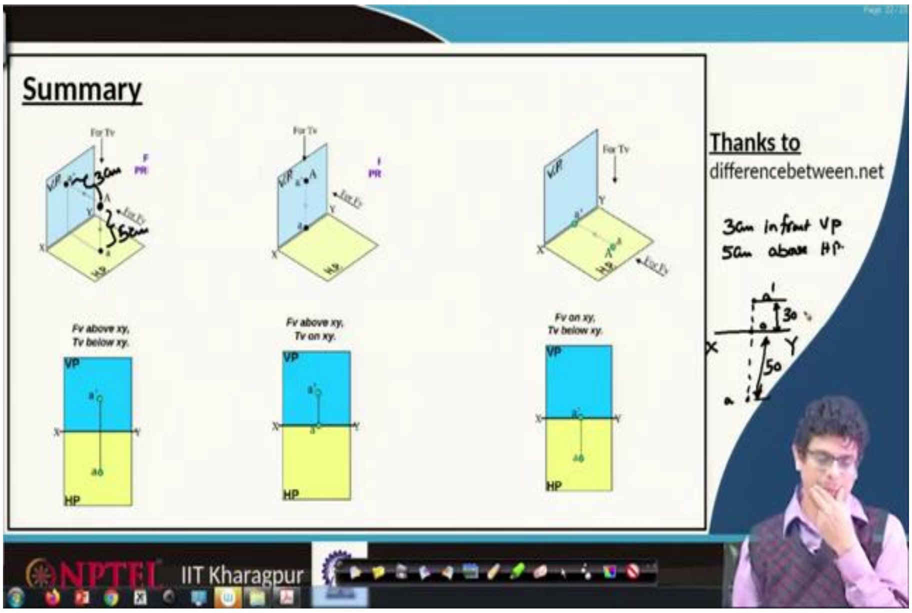

Let us consider a point 3 centimetres in front of the vertical plane. And, it is at 5 centimetres above the horizontal plane; that means, it comes under this kind of category. 3 centimetres in this direction, 5 centimetres in this direction; that means if we are drawing this one X Y plane above that locate a point a' call this one o project it.

Similarly, this point is a. So, that this dimension becomes 50 mm and this dimension becomes 30 mm. So, in the next class, we will learn more about line projections.

Thank you very much.