Engineering Graphics and Design
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Week 2: Graphical Representation
1st and 3rd angle projections

Welcome back to week 3 of Engineering Graphics and Design. In previous, last two lectures, we discussed about different kinds of projections, and about the multi-view projections. So, previously, when we discussed about the three things the object, projection plane, and the observer, we always had the projection plane in the middle.

But what we will see now is it is not sacrosanct, which means the projection plane can be at one extreme and the object also can be at the middle. So, now you have an option whether to put the object at the middle or the projection plane in the middle. So, this leads to two different angles of projections called the first and third angle projections. That is what we will be discussing in this lecture.

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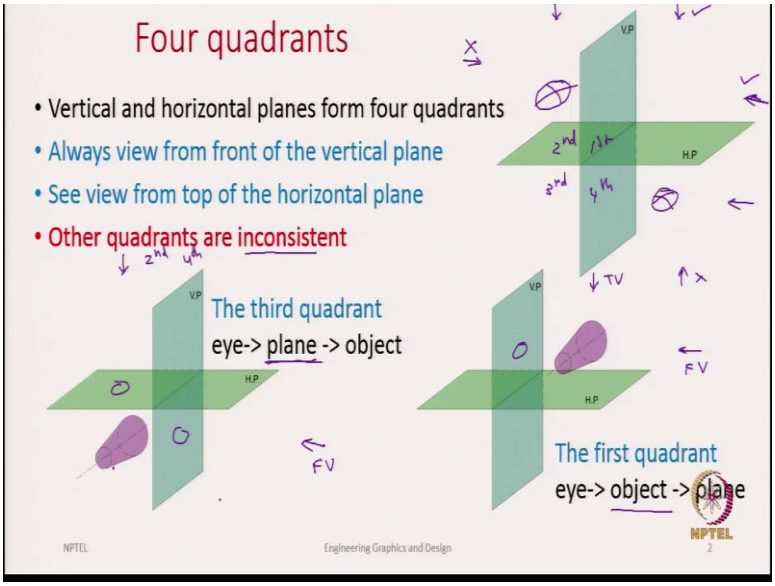

So, now, if we look at the horizontal and the vertical plane, we know it will divide the space into four quadrants. So, which we call them as the first quadrant, second quadrant, third quadrant, and the fourth quadrant. So, there are two important principles about where the observer should be looking at to capture the front view and the top view.

The first rule is, says that always view from the front of the vertical plane. So, let us say you have an object and you are looking in this direction to capture the front view. You should be looking in from the front of the vertical plane, which is correct, you should not be looking

from the back, so which is wrong. Similarly, to capture the top view, it says that you should always view from the top of the horizontal plane.

So, if you want to capture the top view, you should be looking from the top of the horizontal plane, not from the below. So, this will be the right way to do it. And this is the wrong way to do it. So, no matter where your object is, your object, you can place it in the first, second, third, or the fourth quadrant.

But these two rules should be followed. Saying that to capture the front view, you are looking from the front of the vertical or the frontal plane. And to capture the top view, you are looking from the above or top of the horizontal plane. So, now once we have these two rules, we will see that though we have four quadrants, we only have two real possibilities. So, now let us think about the object placed in the third quadrant.

So, to capture the front view, we said the observer should be looking in this direction. So, the observer should be at the front of the vertical or the frontal plane. So, if you are doing it in this fashion. Now, what do we see, what is in the middle is the projection plane, we have the observer and the object at two extremes and the projection plane is in between to capture the front view.

So, we will capture it somewhere here. So, now, to capture the top view, the second rule says you should be looking from top of the horizontal plane. So, which means again, what happens is you see that the projection plane falls in between the observer and the object, so you will capture the view somewhere. So, in both the front view and the top view, what we are noticed is in the middle, we have the projection plane.

If you notice the last two lectures, we followed this principle, we always, without talking about all these rules, we simply said the projection plane is always in the middle. But now we will see the other possibility. So, the other possibility is if you place the object in the first quadrant. Now, you will notice that if you want to capture the front view, the first rule says you should be looking from the front of the vertical plane.

So, if you are looking from the front, what is at the middle? What we see at the middle is the object. So, the object is in the middle of the observer and the projection plane So, where do we capture the front view? We capture the front view somewhere here. So, this is for the front. Now what about the top view? So, if we look at the top view.

Again, the second rule says, to capture the top view you should be looking from above the horizontal plane. So, here is the observer, we have the object and the horizontal plane is the projection plane. Then what do we notice that, again, the object is at the middle, and the observer and the projection plane are at the two extremes.

Now, let us see why we cannot use the second and the third quadrant. We said the other quadrants, which are the second and fourth quadrants are inconsistent. Now let us assume that your object is in the second quadrant, something like this. Now, to capture the front view, we will use the first rule and say that, okay, you are looking in this direction. So, what is in the middle? The projection plain.

But now, let us move to the top view and see. So, once we capture, trying to capture the top view, we now notice that the object is at the middle. It is not the projection plane, but the object. So, for the front view, we have the projection plane at the middle. And for the top view, we have the object at the middle. That is why we call that as inconsistent.

So, depending on the view, sometimes the projection comes in, projection plane is in the middle, and sometimes the object is in the middle, the same case with the object being placed in the fourth angle, or the fourth quadrant. So, when you are trying to capture the front view, you have the object at the middle. But if you are capturing the top view, now you see that the projection plane is in the middle.

Again, we have a mix for the front view, we have the object at the middle, for the top view, we have the projection plane at the middle. That is why we say that the other two quadrants, which are the second and fourth quadrants are inconsistent. So, which leaves us with either to follow the third quadrant or the first quadrant. So, in practice, people follow both depending on the location, they are working with. Most European countries, they follow the first angle projection where they place the object in the first quadrant.

But mostly in North America, the US, and Canada, they follow the third angle projection, where they place the object in the third quadrant. And there are, nowadays design is global. So, many countries follow both the conventions. Since there are two different conventions, and the views we will see later will be different, that needs to be informed on the engineering drawing paper.

So, we will look at what is the differences between the first and third angle. How will it change the views and we will also see how do we, once I get an engineering drawing.

Looking at the drawing, there are some symbols which mentioned whether it is first angle or third angle. So, we look at both these aspects as we go along.

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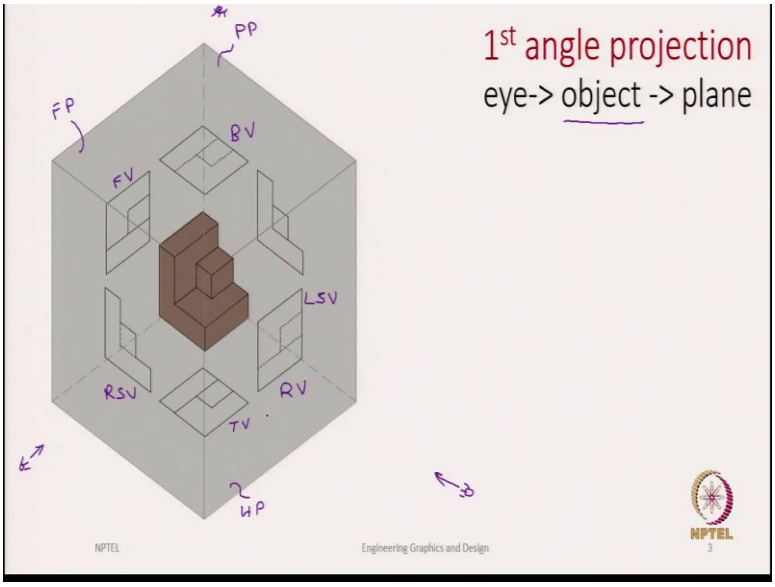

So, as I already said, the third angle projection is what we are already covered in the last two lectures where we had the projection plane in the middle. So, now having the object in the middle is something we have not looked till now. So, let us use the box concept again to see how do we capture the views in the first angle projection.

So, here we have the box and then the object. So, like last time, we need to keep the, place the object at the middle of the, or the center of the box. And then we start capturing the front view. So, when we capture the front view, mind you the eye is somewhere here and these are the direction of the projectors. So, in first angle projection, we said the object is at the center.

So, we already defined the observer, we have defined the object and what is remaining is to pick the projection plane. Since it is in the other extreme, we pick this as the frontal plane to capture the front view. So, now let us capture the front view. And here we have the front view. Similarly, we will proceed to get the top view. So, for the top view again we have placed the observer at the, above the viewing plane.

So, once the observer and the object is chosen, the only thing remaining is to choose the plane or the projection plane, we say that this is the horizontal plane on which we are capturing the top view. So, this is the top view we have captured. And then we will look at the side view. So, let us say we are looking, at capturing the left side view where we placed the eye is somewhere here. And this is the direction we are looking at.

So, the observer is defined, object is defined and then the projection plane is at the other extreme. So, this is the profile plane on which we will capture the left-side view. So, the red lines are the projectors and now we have captured the left side view. Let me write it down, left side view. The same procedure you can repeat to capture the right-side view, the bottom view, and lastly the rearview.

So, in this fashion, we captured the 6 basic views, which we can capture from this object. So, like last time again, we need to notice that all these views though they are individually 2-D. Since now we have 6 views, these are all again in the 3D space, we need to bring them all to one single sheet of paper. How do we do that by opening the box.

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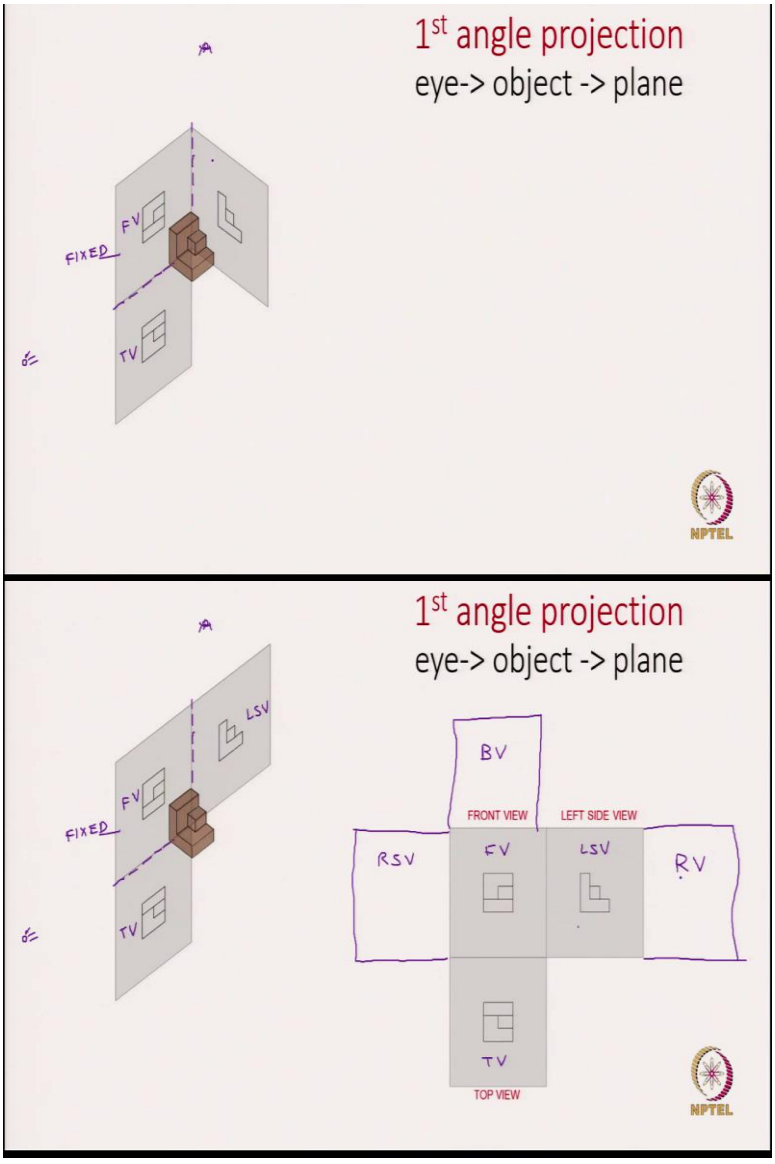

So, again we have the object and we capture the front view. Next, we captured the top view. So, from here onwards, you need to pay a little more attention because things become a little counter intuitive . So, we said this is the front view. And now we are capturing the top view from looking from above. So, now what we captured is top view. So, what did we say previously?

When we open the box, we said since front view is the primary view it is captures the important features, we do not move it. Which means the front view is fixed. What we instead do is we rotate the other views. Here, we rotate the top view, how do we rotate? We rotate it about the common edge between the vertical plane and the horizontal plane. So, this is the common edge and now let us see how it looks like once we rotate gradually. So, after we rotate this is actually the top view.

Similarly, now let us say we are capturing the left-side view. So, again, we place the eye to the left and capture the view on the profile plane. So, we have captured the view on the profile plane. And again, we need to rotate it such that it comes and be parallel with the front view. So, again, on what axis do we rotate? We rotate at the axis which is common to the vertical plane or the frontal plane where we captured the front view. And the profile plane where we captured the side view.

So, this dotted line is the common line and we gradually rotate. So, after we rotate, this we name it as the left side view. So, now we know how these three views are aligned with respect to each other. So, the main view is the front view. The top view, if you notice, it is placed below the front view. So, here is what I meant by it is counter intuitive.

So, we call it as a front view, but the location of the top view is placed below the front view, and left side view we place it to the right of the front view. So, this is why I keep calling, saying that it is counter intuitive because though we are talking about the left side view, we place it to the right side of the front view. And when we are talking about the top view, we place it below the front view.

And what about the remaining three views, the right-side view, bottom view, and the rare view. So, replace the right-side view to the left of the front view. And where do we place the bottom view, we place it above the front view. So, bottom view, we placed it above the front view. And lastly, the rear view, we said we always place it to the next of the left side, so we can place it here.

This completes all the six basic views we have all done in the first angle projection. Again, I try to repeat saying that things are a little counter intuitive in the first angle projection because the top view goes below the front view. Similarly with the left side and the right-side views, talking about the left side view, you place it to the right of the front view. And for the right-side view, you place it to the left of the front view.

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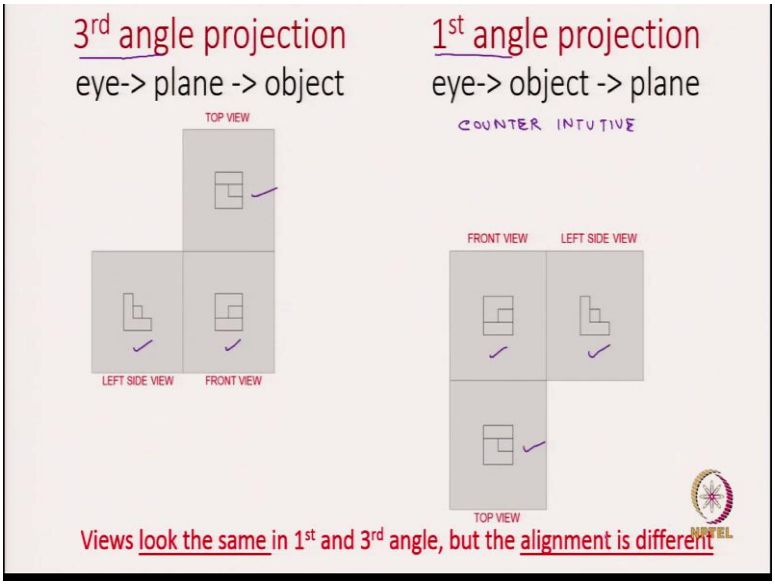

If you are, if there is a confusion, let us try to contrast with the third angle projection so that you can see the big picture in one single slide. So, to the right is the first angle projection and to the left is the third angle projection. We said the first angle projection is counter intuitive. Where we placed the top view below the front view.

But if you look at the third angle projection, you will notice this is more intuitive because the top view is placed above the front view and the left side view is placed to the left of the front view as we expect. However, in the first angle projection, we need to remember that the right side, left side view should be placed to the right and the top view should be placed below the front view.

But there is one important point to note. What changed between the first angle projection and the second angle projection? The views are the same. If you compare the front view between both angles of projection, they are the same. Also, if you compare the left side view, there is no change both look the same. The same with the top view, they all look the same, the only difference is where they are placed with respect to each other changed.

So, that is why we say the views look the same in both first and third angle projections. But the alignment is different, or the placement of the views is different. So, coming back, how do we know whether something is drawn in a first angle projection or a third angle projection because let us say one of my colleagues or I get an engineering drawing from some other person.

Since the person will not be with me, I need to just by reading the drawing know whether this is drawn in the first angle projection or this third angle projection. For that what we do is there is a symbol which we use at the bottom of the sheet. So, there are one single specified for first angle projection and second symbol specified for third angle projections.

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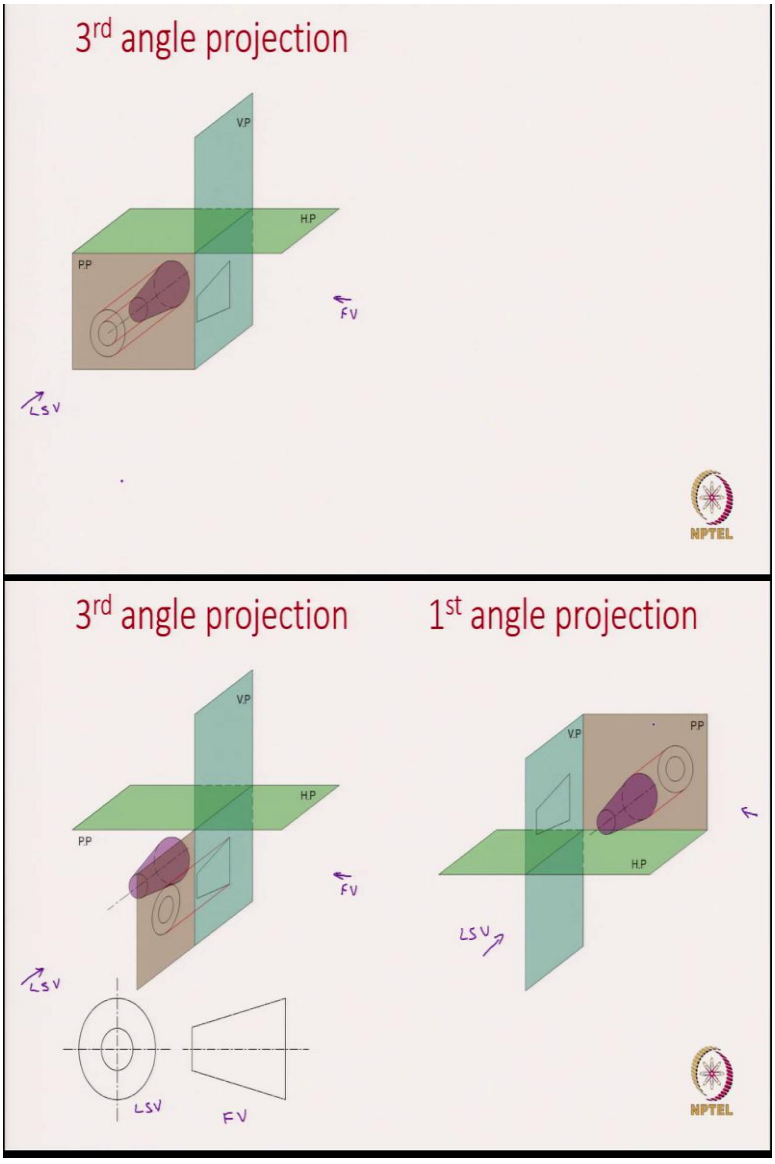

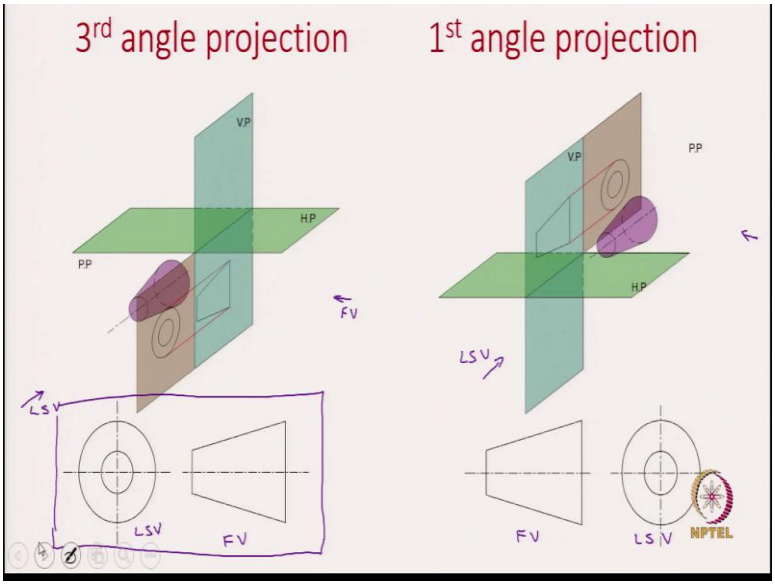

So, now we will see what those symbols are and what they mean. So, the object we consider to come up with that symbol is a frustum of a cone. So, here we have a part of a cone and it is cut parallel to the base of the cone. So, as you can see, first we start with the third angle projection. And when we capture the front view, you remember in third angle projection, the projection plane is in the middle.

So, if you are trying to capture the front view, what we see is a trapezium. Now, once I am trying to capture the left side view, I look it from this direction to capture the left side view. And this is the profile plane on which I am capturing the left side view. So, what we see is two different circles. One, the bigger circle captures the base of the object and the smaller circle captures the circle where we made the cut in the original cone.

So, but when we open it previously, we have seen, we do not move the front view, we only move the other views. So, here we rotate the side. So, now you can see that these concentric circles which we captured as the left side view is placed to the left of the front view. So, this is your front view, and this is the left-side view. So, now let us repeat the same process for the first angle projection and now see for the same object, how these views look like.

So, again, we take these horizontal and vertical planes and make them as four quadrants, we placed the same object in the first quadrant. So, here is this frustum of a cone in the first quadrant, and when we are trying to capture the front view. So, we capture it on the vertical plane. So, again, we get the same view which is the trapezium on as the front view. So, when we capture the left side view, again looking from this direction, to get the left side view, we captured it on the profile plane.

So, we said again, we need to rotate the profile plane such that it is in line with the vertical plane where we have the front view. So, now let us rotate. So, after rotation, what we see is the left side view is placed to the right of front view, as is expected in the first angle projection. So, here we have the trapezium as the front view, and these concentric circles as the left side view.

So, now let us contrast between the first angle and the third angle projection. So, in the third angle projection, we placed the side view or the left side view to the left of front view. And in the first angle projection, we placed the left side view to the right. Essentially, the point being, the concentric circles are placed to the left, if it is a third angle projection.

Those concentrate circles are placed to the right of the trapezium, in case of the first angle projection. So, these two together make the symbol. So, when I look at any drawing, there is a place where you need to place one of these symbols depending on whether you are drawing it in third angle or the first angle projections.

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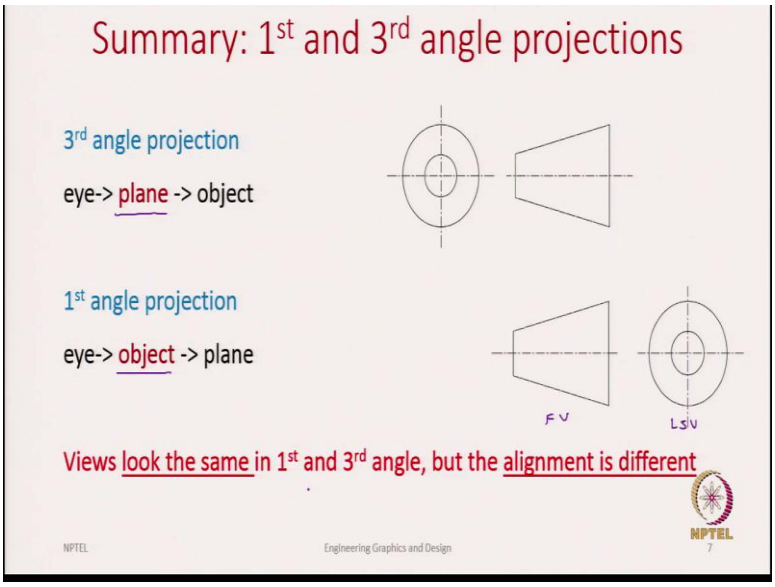

So, in summary, what did we learn in this lecture. We said, for a third angle projection, we have the plane at the middle. And we also said that this is the symbol we use for the third angle projection, where the concentric circles are placed to the left of the trapezium. However, in the first angle projection, things become a little counter intuitive.

We have the object at the middle, and we have the left side view placed to the right and top view place to the bottom, which are counter intuitive, but over time you will get used to. So, for example, these are the symbols we use for the first angle projection, you need to show

both the front view and the left side view. You need not write this but looking at this trapezium and this concentric circles to the right one should be able to understand that we have done this in the first angle projection.

So, again, as a last point, I am reiterating that either you do it in the first angle or third angle, the views will remain the same. So, your left side views whether it is in the first or the third angle projection will look the same. The only difference is where you place the views. So, in the third angle projection things are more contrary, I mean, sorry, more intuitive, in the sense like the top view is placed above the front view.

Whereas in the first angle projection things are counter intuitive in the sense that the top view is placed below the front view for a first angle projection. So, that is it for this lecture. Thank you for joining.