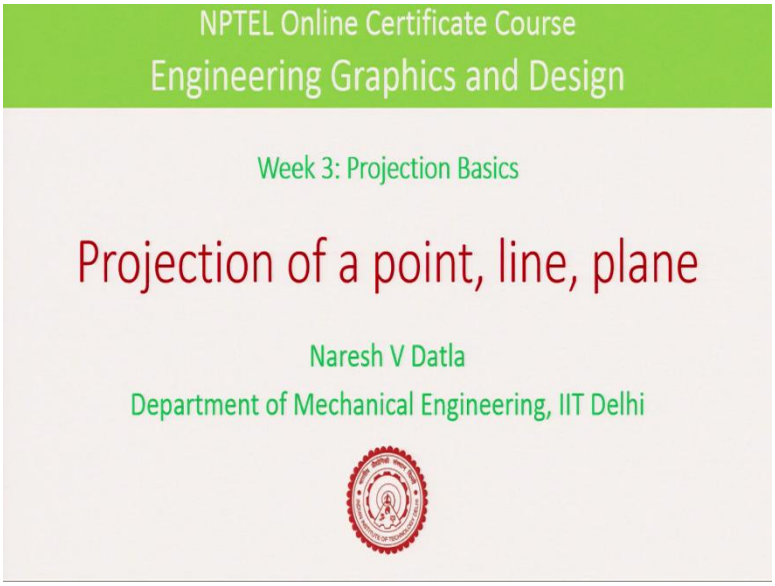
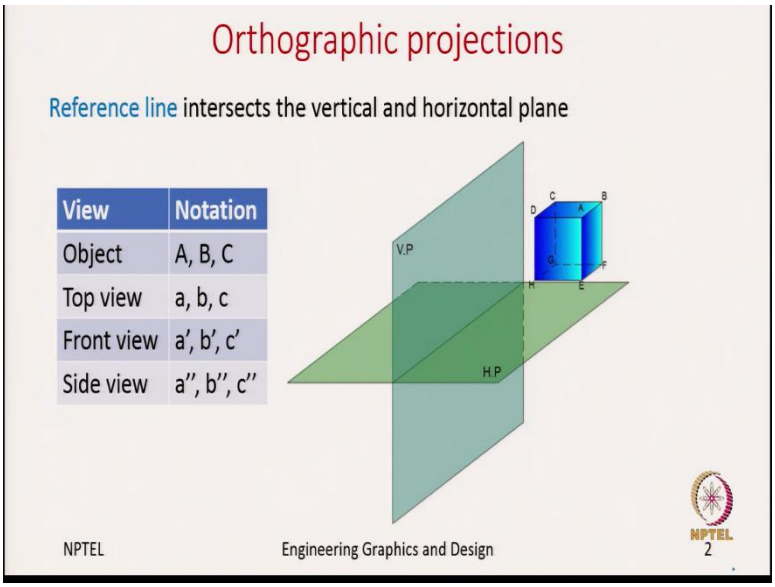
Engineering Graphics and Design
Professor Naresh V Datla
Department of Mechanical Engineering
Indian Institute of Technology, Delhi
Lecture 4
Projection of a point, line, plane

(Refer Slide Time: 00:08)



Welcome back to this course of Engineering Graphics and Design. We are on week 3. In the last few lectures of this week, we have looked at the formal basics of engineering drawings. We started by knowing what the various drawing sheets are, then we have looked into the scales, sizes. We also looked into different kinds of lines as well as we also looked into the different dimensioning's. So, in this lecture we will be looking at engineering drawings with very simple things like point, line and a plane.

(Refer Slide Time: 00:57)



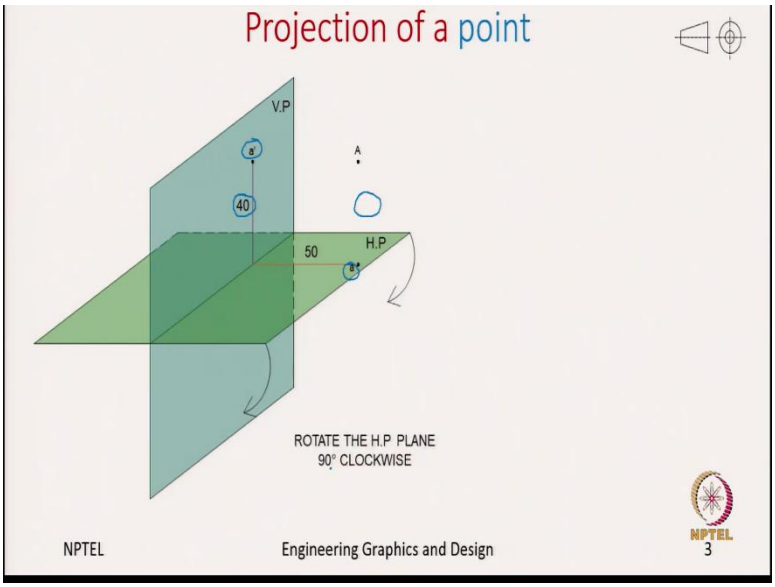
So, on this slide what you see is a cube which is placed in the first quadrant. So, the first quadrant is defined by two planes as we all know by now these are the vertical plane and the horizontal plane. So, the cube now is in the first quadrant which is in front of the vertical plane and above the horizontal plane.

So, let us introduce a new terminology called a reference line. This is the line with intersects both the vertical and the horizontal planes. You will see later when we start doing engineering drawings, we need this reference line because this reference line separates the front view and the top view.

There are few notations we will be using in this course which are for the object, any point on the object we represent using a capital letter like A, B, C all in capital letters but the same points when they are projected in the top view, we represent them with the small letters, again a, b, c in small letters. The corresponding points projected onto the front view, we represent using a prime, b prime and c prime. And lastly for the side view, we introduce the double prime. So, a double prime, b double prime and c double prime.

So, these are the notations we will be using in this course but however if you look at different reference books these notations may slightly deviate. I think there is no standard rule for this but depending on how you are comfortable with you can go ahead with it. Okay, so let us start with the simplest of the projections which is the projection of a point.

(Refer Slide Time: 02:56)



So, here I will be showing you to the top right corner we have a symbol for the projection from looking at that we should now know this is a first angle projection. So, here is the point A, which is in the first quadrant which is above the horizontal plane by units 40, 40 units and it is in front of the vertical plane by 50 units.

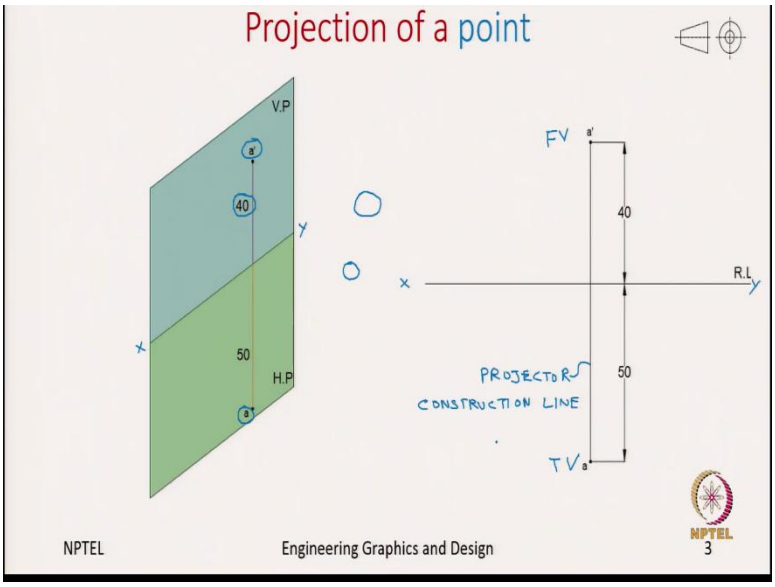
So, now let us see how do we capture the front view and the top view. Here we are trying to show you in a pictorial fashion for better visualization. This is not what we draw, so what we draw I will just come to that in a moment but let us first visualize how we are capturing the front view and the top view. So, to capture the front view, we place the observer front of the vertical plane and then we capture the front view. The front view as we just have seen in the previous slide, it is notated with a prime.

The prime represents that this is we are capturing the front view. So, here is a prime. Similarly, so very important point now is we are discussing about orthographic projections where the projectors are normal to the projection plane. The reason why these orthographic projections are very important is because as you can see previously we know that the point A is at 40 units from the horizontal plane and even the front view the point a prime or the a dash is at the same 40 units from the horizontal plane.

So, which means you need not worry about how these dimensions change. So, the same 40 units is captured in the front view. Now, let us move to the top view. Now the eye is placed on the top and then we capture the top view. So, here is a, the small letter ‘a’ for the top view and this is at a distance of 50 from the vertical plane.

So, now we have captured both the front view and the top view but as we know they are still in the three dimensional planes because front view and the top view are now captured in two perpendicular planes. We need to bring them back to a single plane for that we know the front view is a main view, so we do not disturb the front view but instead what we do is the top view we rotate such that it aligns with the front view. So how do we do that? We rotate it, so we rotate the horizontal plane by 90 degrees in the clockwise direction.

(Refer Slide Time: 05:56)



So, let us see how it looks like. So, after rotation now we have the point ‘a’ mentioned here. In the last few minutes, we have only seen the visualization I am trying to show pictorially how to capture the front view and the top view of this point but if you and I are working on a drawing sheet, how do we do that? To do that first what we use is the reference line.

Reference line as we just defined is the line which intersects the horizontal and the vertical planes. So, in this case let us say this ‘xy’ is the reference line which we represent here. So, we use a continuous narrow line. So, first let us start with the front view. Front view we said is a prime which is 40 units above the reference line as shown in this pictorial.

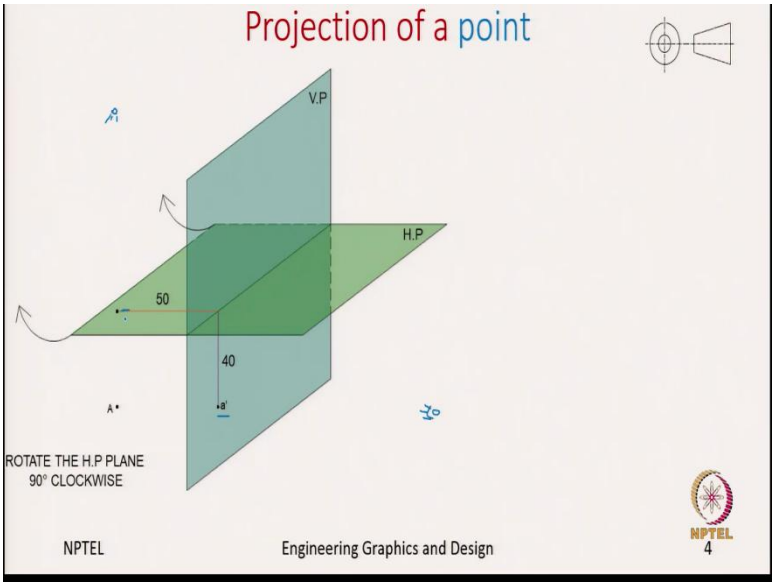
Now, to get the top view here is the important point saying that we now draw a vertical line which is perpendicular to the reference line and this perpendicular line we continue and since we know that the top view is at a distance of 50 from the reference line, we dimension it accordingly. So, now we have captured both front view and this is the top view.

This line which connects the same point in the front view and the top view is also called as projectors. We also name this line which we used to connect these or also called as the

construction line. So, we use for construction line, thin lines, or the narrow lines continuous narrow lines.

So, what we have seen in this slide is how to project a point so that we capture the front view and the top view. In this lecture we will be only focusing on two views which are the front and top view because we are focusing on simple objects more than two views are usually not required because all the information you want to convey is in these two views.

(Refer Slide Time: 08:39)

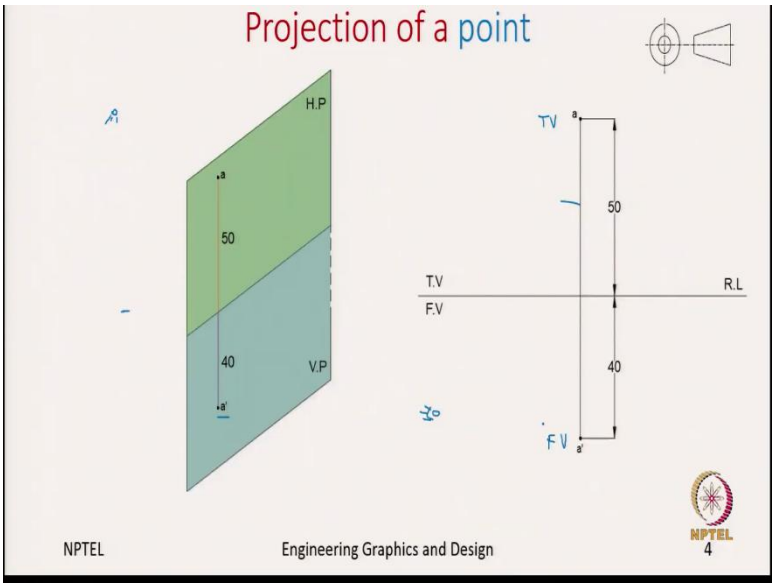


So, now let us again look at projection of a point but instead of working in the first angle projection now we will show it in a third angle projection, where we put the point in the third quadrant. So, here is point ‘a’ placed in the third quadrant which is below the horizontal plane and behind the vertical plane. So, now let us try to capture the front view and the top view.

So, for the front view we place the eye here and for the top view we place the eye above the horizontal plane. So, by doing this we capture a prime which is the front view and now for the top view, we capture the point A. So, which are at a units of 40 and 50 which we already have seen in the previous slide.

So, again we notice that the front view and the top view are in two perpendicular planes, we need to bring them into a single plane. So, we do not disturb the front view because it is the primary view but instead the top view, we rotate such that both the top and front view are in the same plane. So, now let us rotate the horizontal plane again 90 degree clockwise direction.

(Refer Slide Time: 10:03)

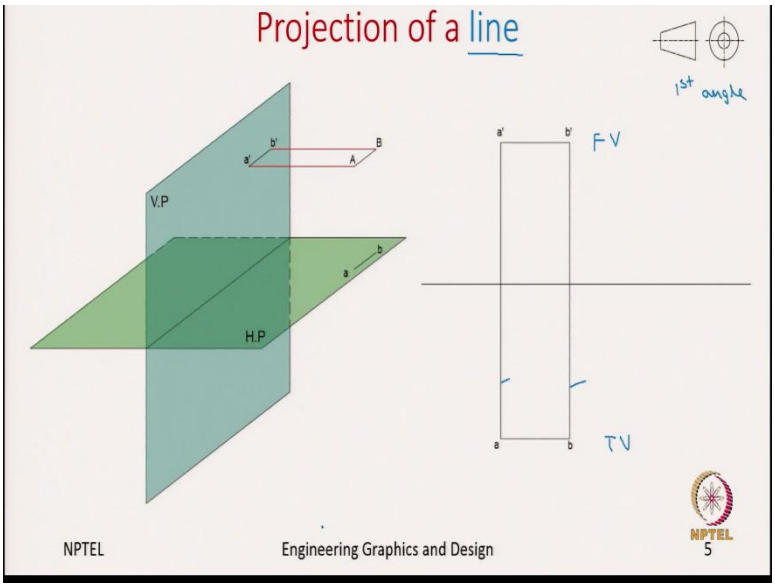


So, after rotation we now notice all of them are in the single plane. So, what we have seen till now is the pictorial representation how we captured the front and top views but now let us see how we draw it on a drawing sheet. So, we start with the reference line, and we now see that the front view is placed below. So let us start with the front view a prime. So, here is the front view where the point is represented by a prime which is at a 40 units from the reference line.

Now, we use a projector vertical line which is perpendicular to the reference line and then note the top view. So, this previously we called as the projector line or the construction line. This connects the corresponding points in the top view and the front view. So, what we have now covered is we have discussed a projection of a point both in the first angle projection and the third angle projection.

The difference between both these projections as we already know is in the third angle projection, top view is at the top and front view is below the top view. However, in the first angle projection, you first draw the front view and the top view is placed below the front view.

(Refer Slide Time: 11:34)



Now, let us move to the next object which is the line. So, from point we are moving to projection of a line. So, now let us consider a line AB. So, this is the line AB which is in the first quadrant. So, this symbol says it is in the first angle projection.

So, again we do the same things like to capture the front view, we notice that this line AB is parallel to the vertical plane or the projection plane. So, when a feature is parallel to the projection plane, we capture the true length which means if the length AB is let us say 30 units even in the front view the same dimension of 30 units is captured.

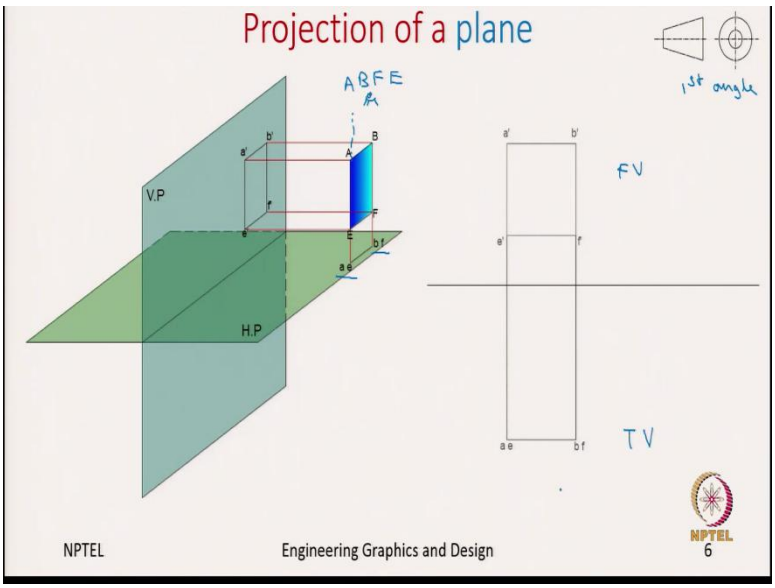
So, as I already said for the front view we represent with a prime and b prime and now to capture the top view by placing the observer at the, above the horizontal plane, we capture the top view. Even in this top view, we notice that this line AB is parallel to the projection plane. Here the projection plane is the horizontal plane since the line AB is parallel to the projection plane, we capture the true length of AB. And we represent in top view with small letters a and b.

Now let us see how we ah draw this top view and the front view of this line on a drawing sheet. Again, like any other things we start with a reference line and then start with the front view. So, the front view is of a dash b dash, let us say it is 30 units and depending on how far it is from the horizontal plane, the same distance will be captured in the distance between the reference line and the front view a dash b dash. The good thing is now we, since we now know what is the length of a dash b dash in the front view, we can use projector lines to capture the same length even in the top view.

So, these projector lines help us to capture the length of a dash b dash or the line AB in the top view as well. So, now once we connect these points a and b, we get the top view and a dash b dash is the front view. So, one interesting point we need to, one important point we need to specify here is once we capture the front view, we know what is the true length of this line a dash b dash.

That same information we are using to draw the top view. So, you need not calculate or you need not remember the same dimension, you just need to draw those projectors or the construction lines and that will help you to find the length of line AB in the top view, so which means we are using information from one view to draw other views which is this is the advantage of placing these views in a specified orientation like placing the top view below the front view for example.

(Refer Slide Time: 15:04)



Now, let us move to the next thing which is projection of a plane. So, again this symbol says we are looking at first angle projection. So, now let us consider this plane ABFE which is parallel to the vertical plane but perpendicular to the horizontal plane. So, now let us first start by capturing the front view. So, when we capture the front view, we get a dash b dash f dash e dash since this plane ABFE is parallel to the projection plane which is the vertical plane here for the front view.

We see the same shape even on the projection plane. So, the same square for example square or rectangle this ABFE will look the same even in the front view because it is simply parallel to the projection plane. So, it will have the same height and width. Now, let us look at the top view. So, once we look at the top view, we notice that from the top since it is perpendicular to

the horizontal plane, what we see is a single line. We do not see the plane as an area, we just see it as a line. And what do we see?

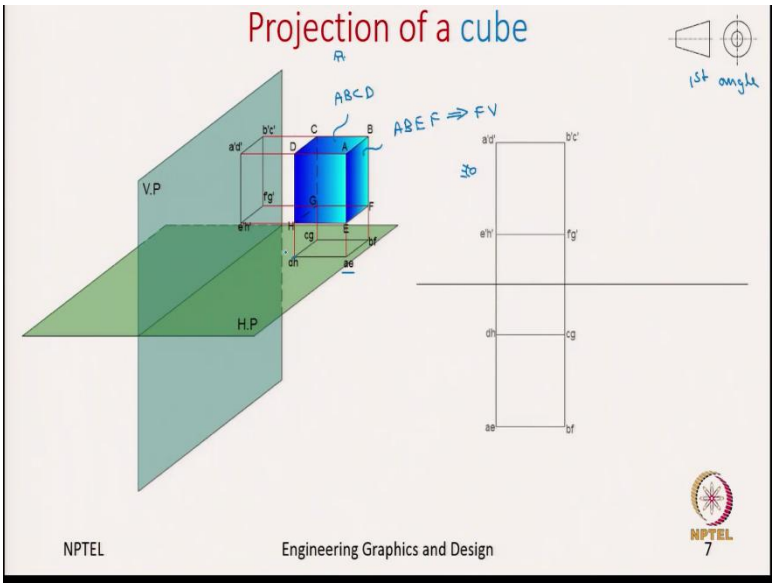
So, if your eye is placed here and you are looking downwards, what one would see is only the line AB because these lines E and F are behind the line AB. So, what you see is only AB but we know that the projection lines are vertical coming down which means this projector line will first touch A and then if you continue with this projector line it passes through the point E and then it projects on to the horizontal plane which means this projector line is passing on through A and point E.

So, how do we represent both these points in the top view. Let us see. So, if you notice we write both the names, points A as well as E, the sequence of these letters is very important because if you see, the projector line first touches point A that is why you first place it A and then secondly it touches point E which is placed next.

So, similarly if you look at the other points B and F, the projector line first passes through B and then through F. So, the same sequence is mentioned in the top view, AE and BF. Now, let us see how we draw it on a drawing sheet first starting with the reference line then capturing the front view and in the front view it shares the same width as the top view. So, using the projector lines you capture the width and then draw this AE, connect the points AE to BF in the top view.

So, this is the front view and the top view. So, again I am repeating saying that we tend to use the information from front view to develop the top view. Similarly, if you are going to other views, we tend to use this information to develop or draw other views.

(Refer Slide Time: 18:46)



Lastly, we will be looking at how to project a cube which means to capture the front view and the top view again we are focusing on the first angle projection. So, here is a cube placed in the first quadrant. Let us name the points ABCDEFGH. So, now once you are looking at the front view, so where we place the eye here or the observer here and you are looking in this direction of course the observer is at infinity or at a very far distance that is when we can justify that the projectors are perpendicular or normal to the projection plane. So, in this front view which face is the observer looking at?

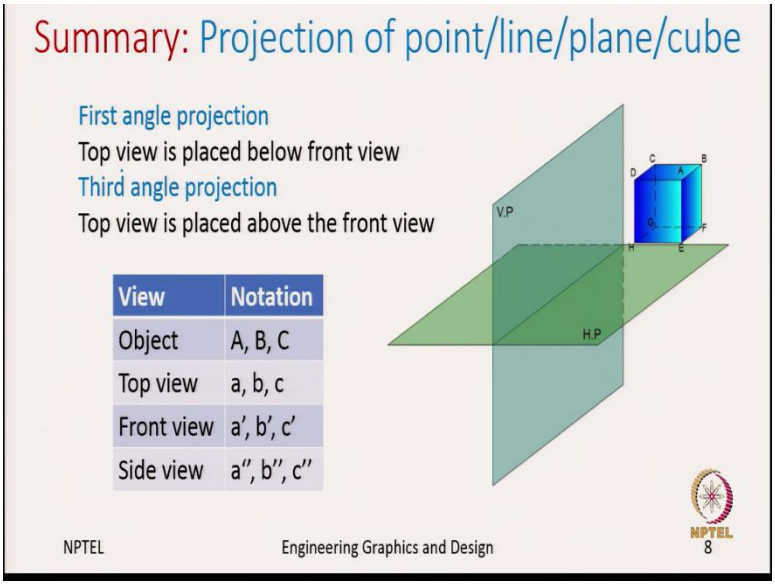
He will be looking at this face ABEF in the front view. So, the face ABEF is visible in the front view. So, let us capture that first, so using the projector lines now you will capture the front face but you will notice that these projector lines first pass through A and then through D so which means you need to mention both these points and the sequence will be first with A and then with D, similarly the other projector lines.

So, since we are talking about the front view, we say a prime, d prime, b prime, c prime and so on and so forth. Now, once we are capturing the top view which means the observer is looking from the top, what he first notices is this top face which is ABCD. This is the surface he is looking in, but since the projector lines continue from A and then pass-through point E, one needs to mention both these points and the sequence will be first EA and then A.

So, you notice how we are mentioning these points, AEDH because the projector line first passes through D and then to H before it projects on to the projection plane. Now, on the drawing sheet you again start with the reference line, first capture the front view name it

accordingly and then use the projector lines to capture the width of this cube using that you again develop the top view and name according.

(Refer Slide Time: 21:22)



So, finally to summarize in this lecture what we have learnt is how to project simple things like a point, a line, a plane and a cube. So, the important thing to remember is if your feature is parallel to the projection plane, you capture the true view.

This is more important when we discussed about projection of a line, a plane and a cube. So, the difference between first angle and third angle projection as we all know now is in the first angle projection the top view is placed below the front view whereas in the third angle projection this top view is placed above the front view.

So, this is the top view which is placed above the front and the notation I think by now we have covered it well saying that for the objects we use the capital letters A, B, C. For top view we use the small letters a, b, c; for the front view we have a single prime with the small letters and for the side view we have double prime.

So, in the next lecture we will be moving on into projection of simple objects and see how we can use what we have studied in this lecture to start developing some simple engineering drawings. Thank you.