Indian Institute of Technology Kanpur
National Programme on Technology Enhanced Learning (NPTEL)
Course Title
Engineering Graphics

Lecture – 27
Space Geometry-2

by
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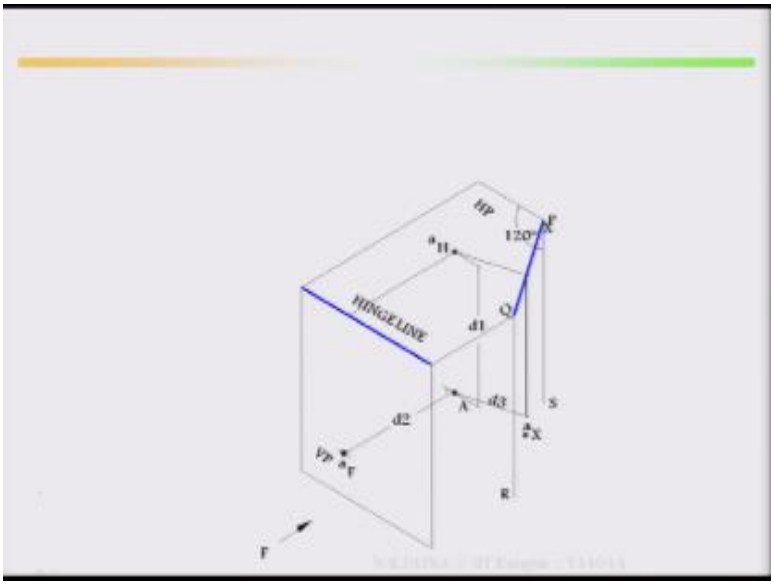

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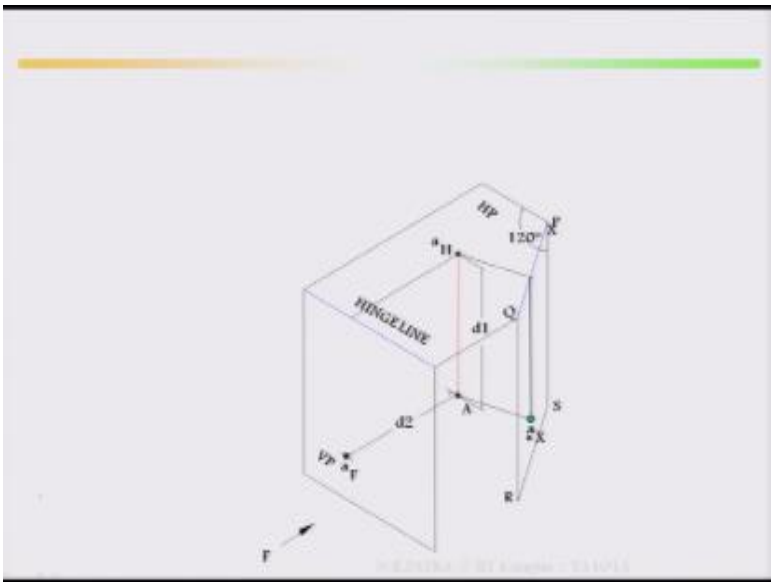

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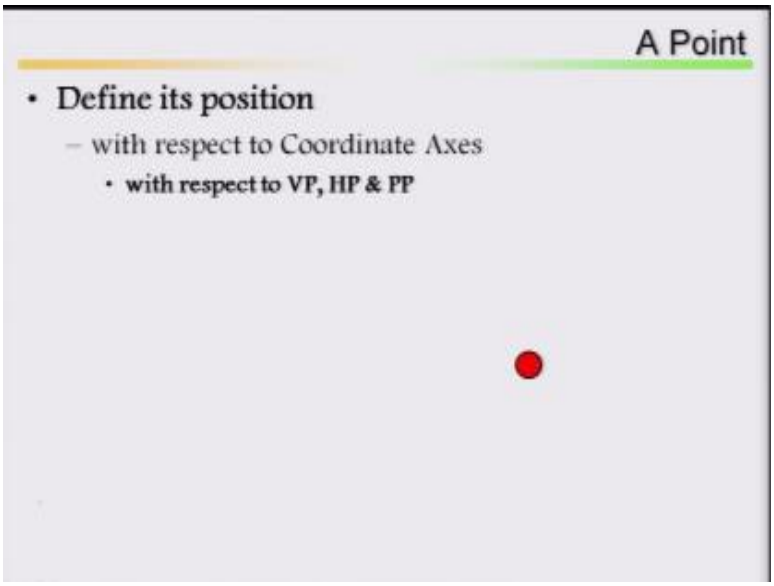

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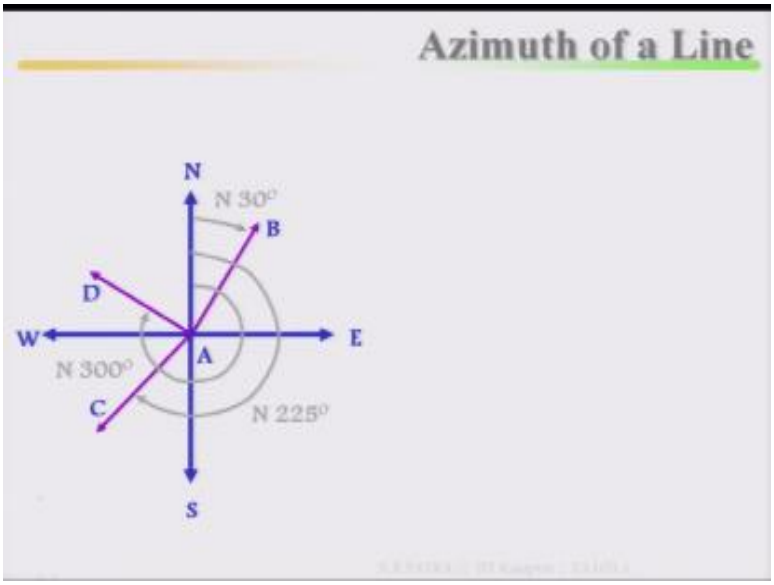

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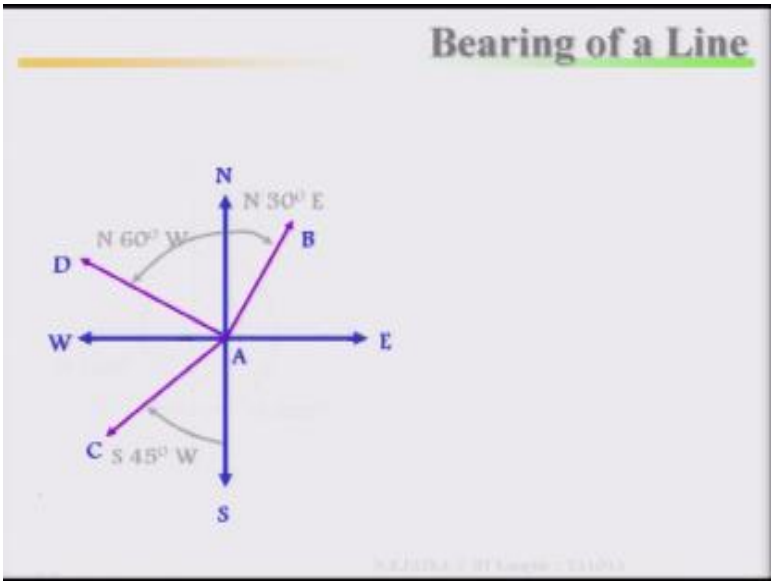

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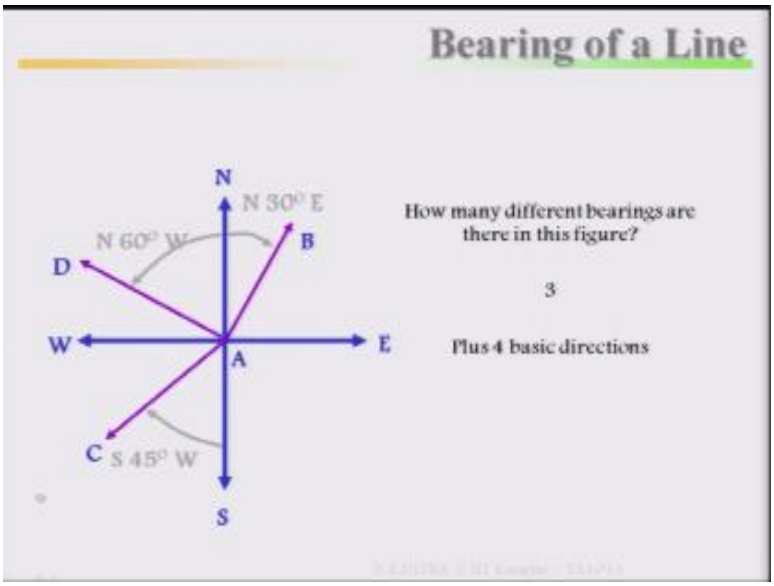

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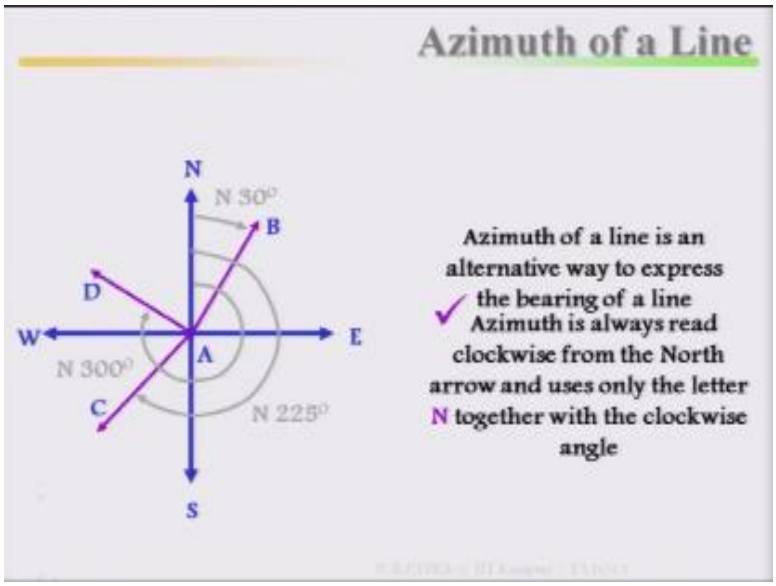

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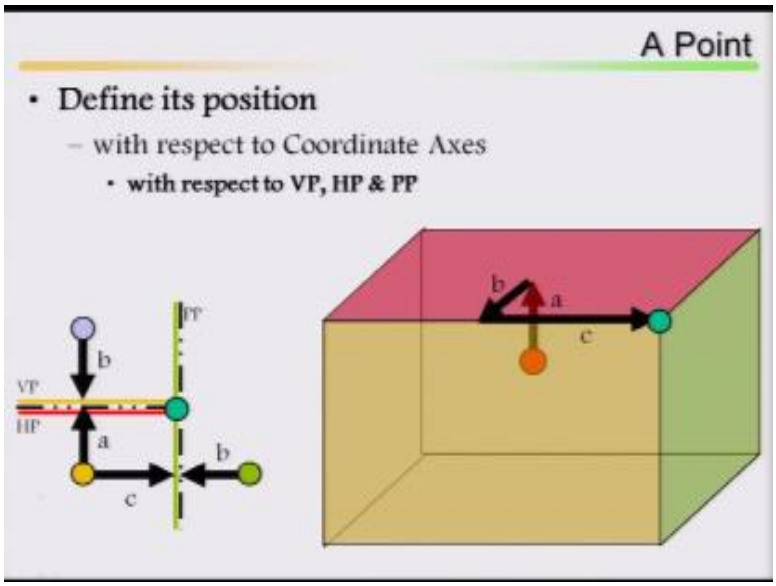

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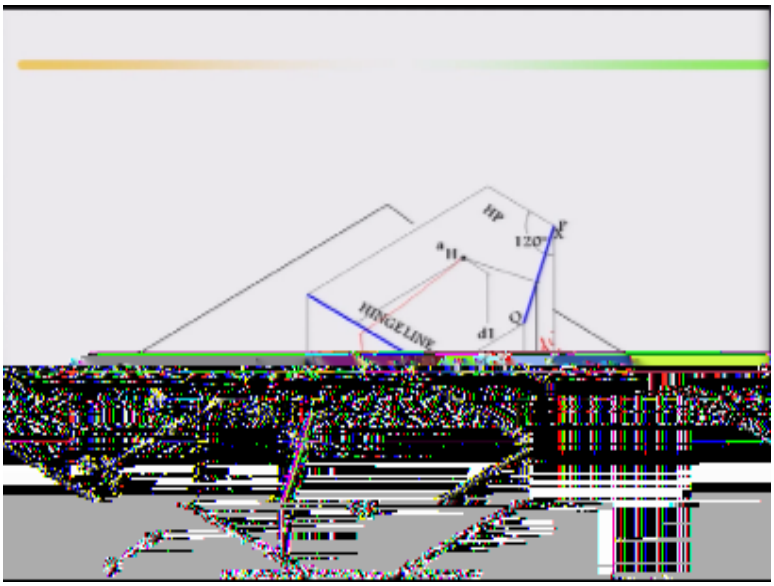

So last class we have covered some part of the interesting part that is about lines by means of rotations, how to get your true length by means of auxiliary plane, how to get the true length. So once again I want to emphasize about this auxiliary plane by 3-D view so it would have be a clear picture to you. If you look at this picture, suppose there is a point here, this is your point in the space. So this point has a distance if you look at here, it has a – this is your front view I am looking the point.

So this point at a distance D2 from the frontal view and D1 from your horizontal view, D1 from your horizontal plane or maybe the top view this is your distance D1 and this is the distance D2. And this is the direction of the front view. If I am considering this 3-D how your true length comes about to be, because maybe possibly this line is going like this A and B.

So what we have discussed by means of auxiliary plane, if auxiliary plane has been drawn with respect to your top view the distance from the hinge line to the front view, what is the distance, that distance will be taken to find it out your true length. Now if you look at this, this is your hinge line, and this is your hinge line. And this plane particularly this plane is your auxiliary

plane. Now in the space this is your point, if this point if you take it from this point to this point the distance is D1.

If I take this D1 moving with this space like this, if I am moving it what does it mean, this distance will come back to – this will come back to your hinge line. That means this is actually in the space this is the distance, from here to your horizontal plane this is actual distance. So this actual distance how do I get it, if I take this hinge line and this is your hinge line with respect to front view, now this point, if you take it this will exactly come to your hinge line.

And now this is your front view this point and this point, then this distance will be same as this distance. This distance D1, if I am taking this point to here I am taking to this here, this distance will be same as this distance. This is your D1, that is the reason, that is the reason why the moment you are taking with respect to front view auxiliary plane, this plane auxiliary plane with respect to front view that means which distance you are going to take it.

So that your point will be exactly located so that you can find it out the true length of the line. So that means exact distance of this point with respect to your top view, that means in the space it is very difficult to measure exact distance, that means in opposite view with respect to, with respect to your front view this distance has been taken why, from here to here distance will be same from here to here distance that is the reason.

Once you are taking auxiliary plane that means this is your hinge line, with respect to hinge line this will be your distance D1. I hope this will clarify what is the reason that opposite view we are taking the same distance, this will clarify.

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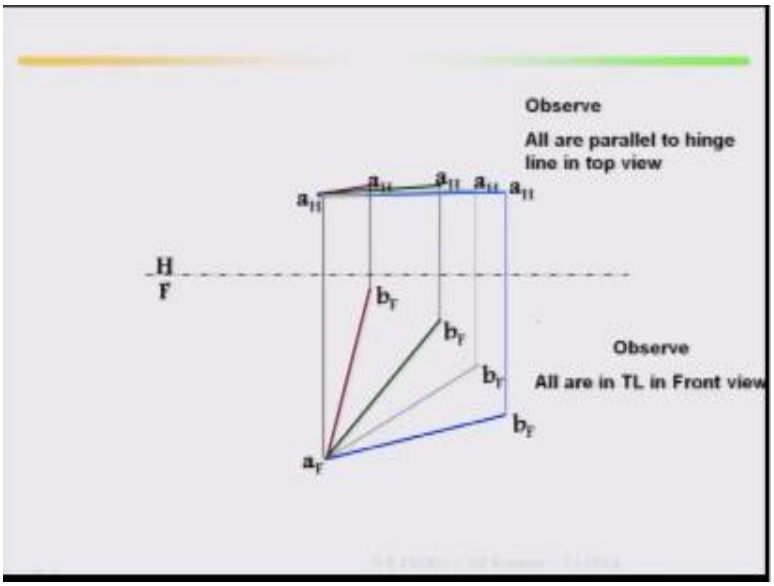

Then this part I have covered it by means of method of rotations.

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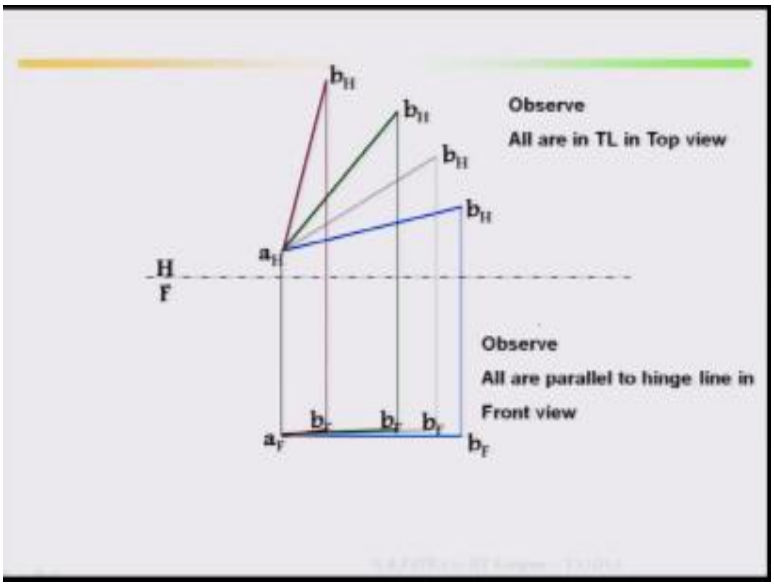

In detail I have finished method of rotations.

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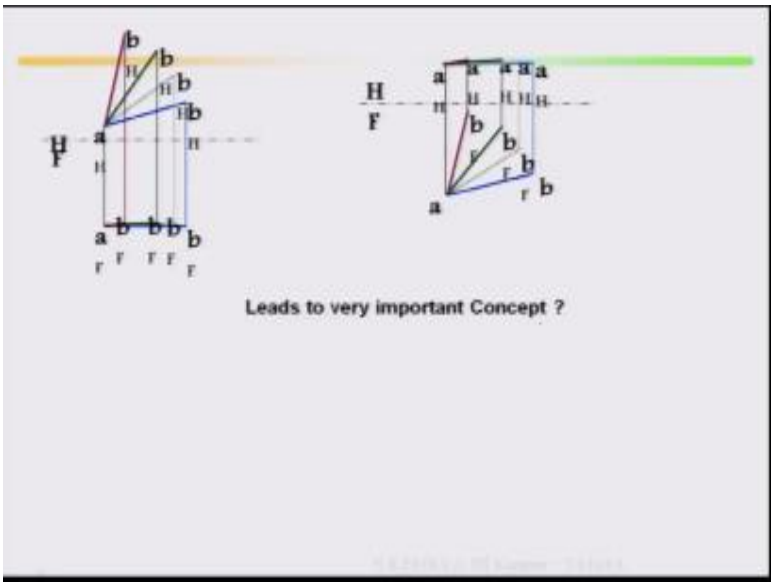

With respect to.

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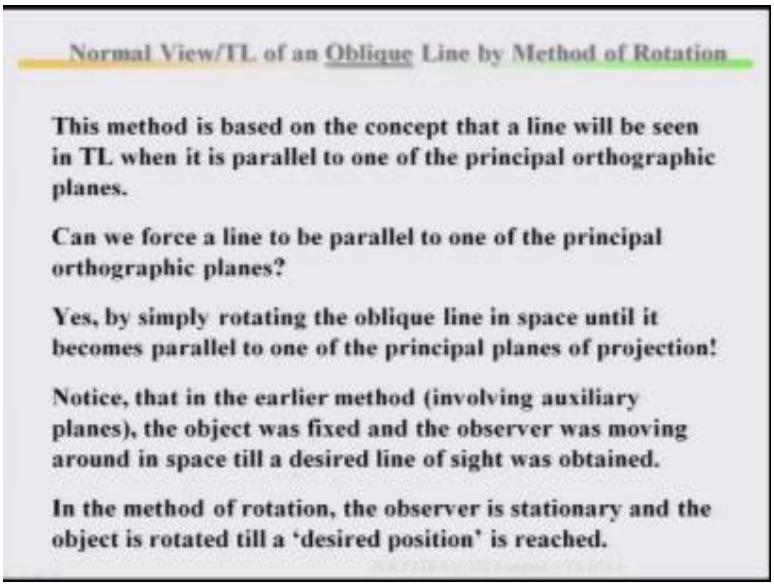

That means how to find it out your true length of a line by means of method of rotation, and what is the difference between method of rotations, as well as by means of your auxiliary plane or your auxiliary view methods. In case of method of rotations observer is stationary, object is rotated, object is rotated till parallel to one of your principle plane. In case of auxiliary plane or auxiliary view where observer is moving around or rotated, where this object is stationary, object is stationary.

Now look at your object was fixed, object was fixed stationary, observer is moving around till you are getting a requisite auxiliary plane, but in case of method of rotation observer is stationary and the object is rotated till a desired position is reached, this is what we have covered up to last class.

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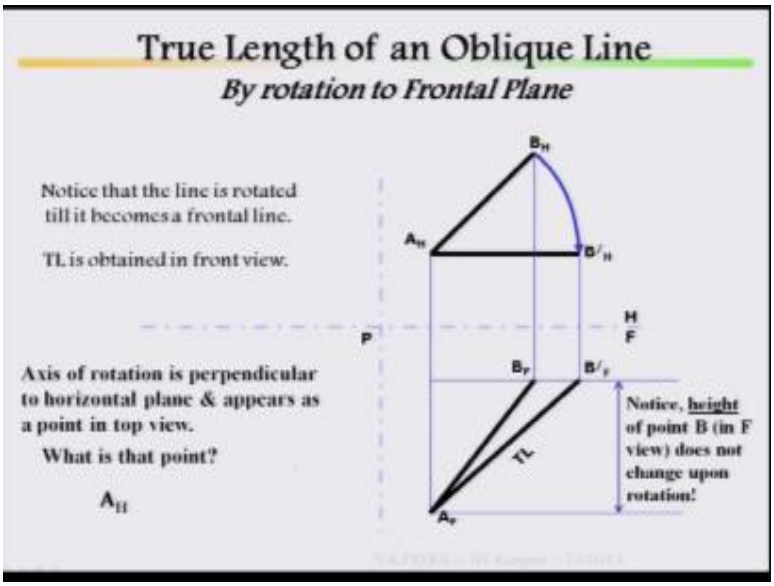

And the rotation with respect to frontal plane, how it has been rotated.

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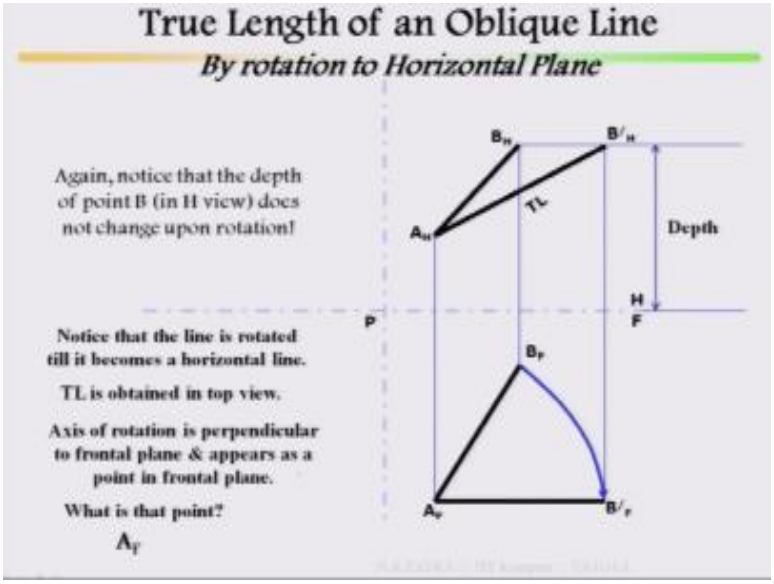

And rotation with respect to horizontal plane and the top view, rotation to horizontal plane, how to get the true length of a line by means of rotation.

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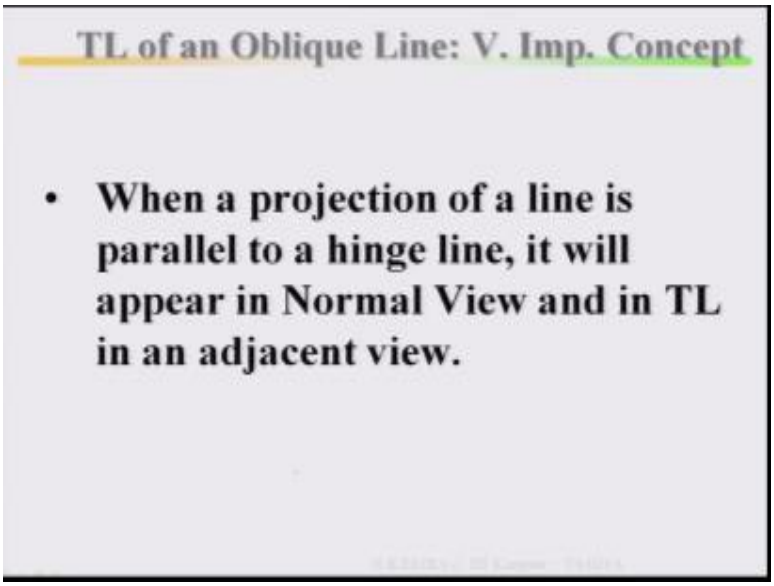

This I have covered.

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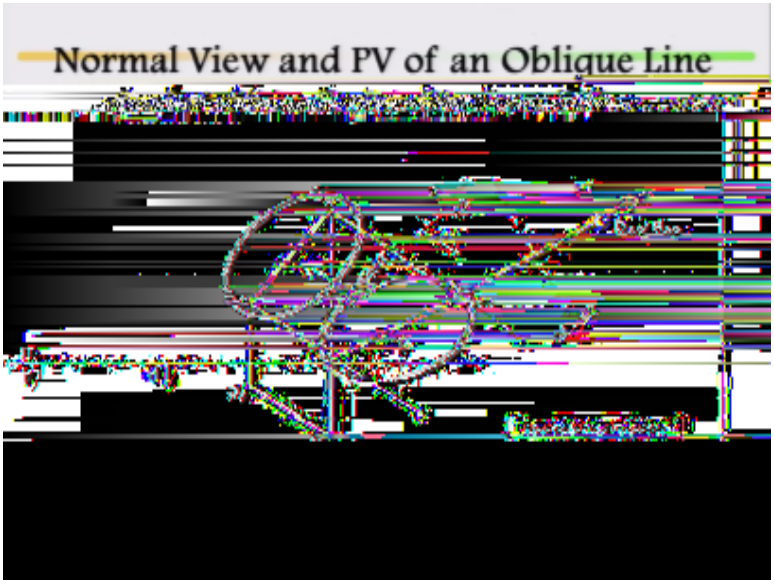

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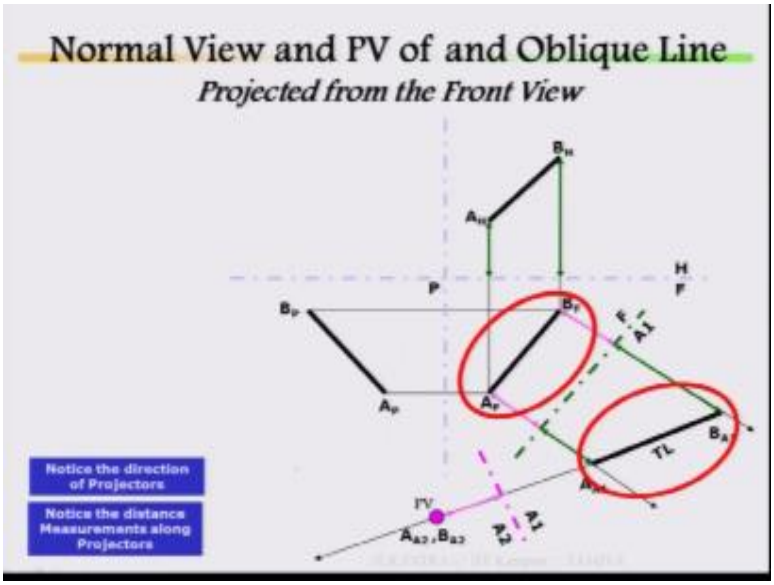

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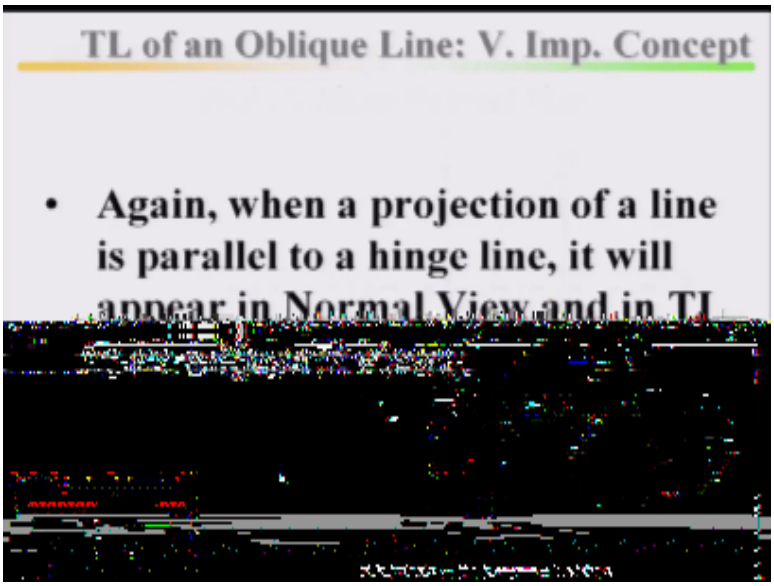

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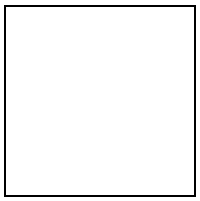

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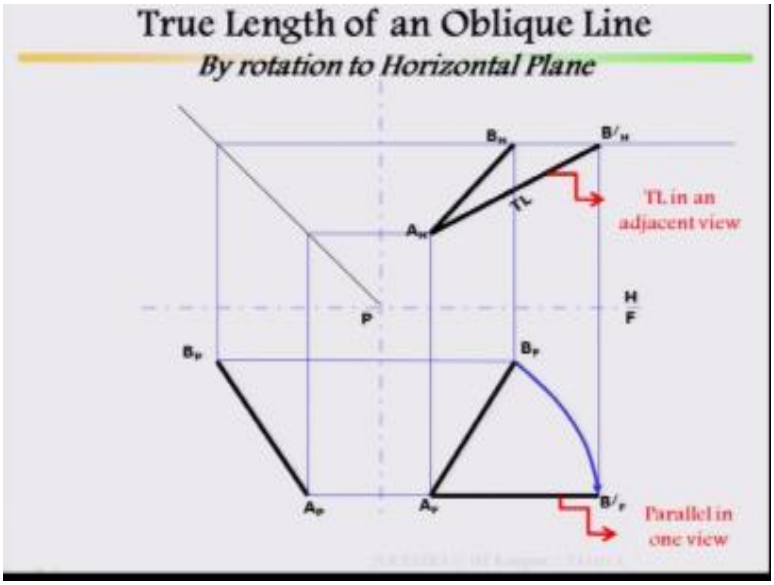

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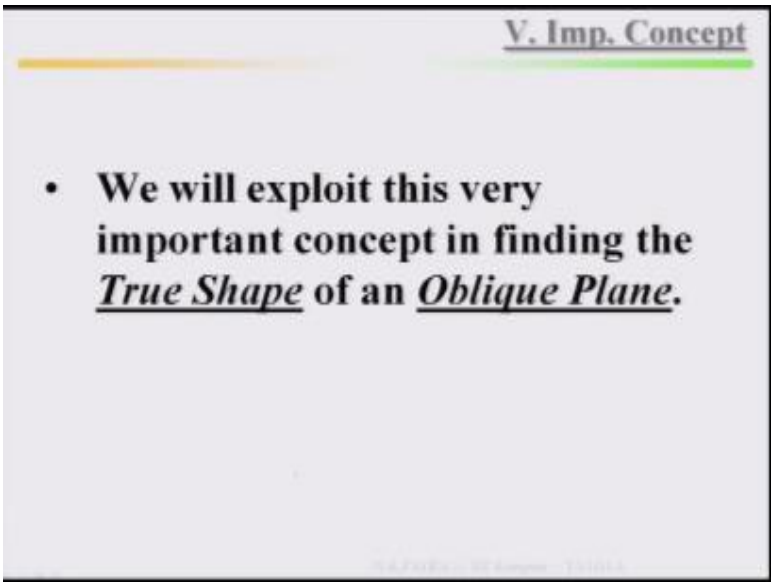

Then we are going to start the next part, this concept by method of rotation concept will be implemented to find the true shape of an oblique plane. Now from line to will go to a plane any oblique plane how to get the true shape of the oblique plane by means of method of rotation or by means of auxiliary plane method or auxiliary view methods.

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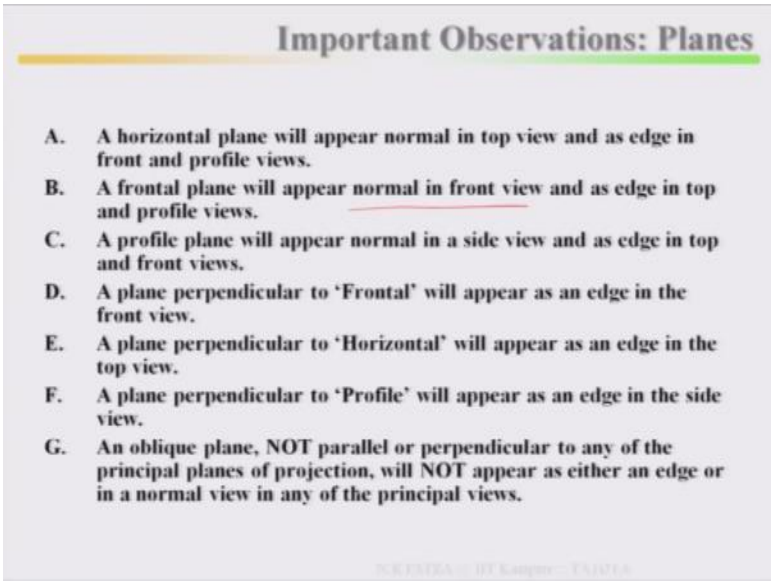

Planes now let us start with this plane, a horizontal plane will appear normal in the top view and as edge in front and profile view. If you take a plane normal in the top view and as a edge in front and profile view, a frontal plane will appear normal in front view and as edge in top and profile view, look at this difference here frontal plane if you are taking the plane in the frontal plane in the front view it will act as a normal to your front view and edge in the top and profile view.

If you are taking with respect to horizontal plane it will appear as a normal in the top view and as edge in front and profile view. Then a profile plane will appear normal in a side view and as edge in top and front views. A plane perpendicular to frontal, mark it a plane perpendicular to frontal will appear as an edge in the front view, a plane perpendicular to horizontal will appear as an edge in the top view.

A plane perpendicular to profile will appear as an edge in the side view, an oblique plane, an oblique plane not parallel or perpendicular to any of the principal planes, the moment you define what is oblique plane that means it is neither parallel or nor perpendicular to any of principal planes or projections will not appear as either on edge or in normal view in any of the principal

views, whatever we have defined an oblique plane neither it is parallel nor it is perpendicular to any of the principal planes of the projections.

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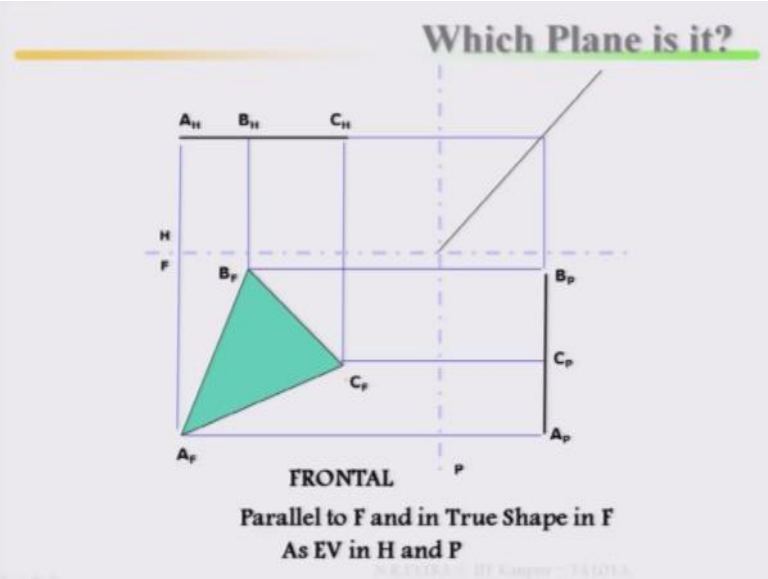

Which plane is it look at this which plane is it, H, H that means it is in the horizontal plane, it is in the horizontal plane normal to this, so parallel to your horizontal plane that means it is in true shape. Any object parallel to your respective plane that is in the true shape in horizontal plane and as an edge view in front and profile, in the front it is an edge view because this point will merge, this will merge along this line.

This will come back, this looks like as an edge, similarly in profile view if you take it, it looks on edge there. Then look at this second part which plane is it. It is in true length in your frontal $A_{F,}$ C_F, $B_{F,}$ that is your frontal plane, then edge view that means it is parallel if it is a true shape that means it is parallel to your frontal, then edge view in horizontal as well as in profile

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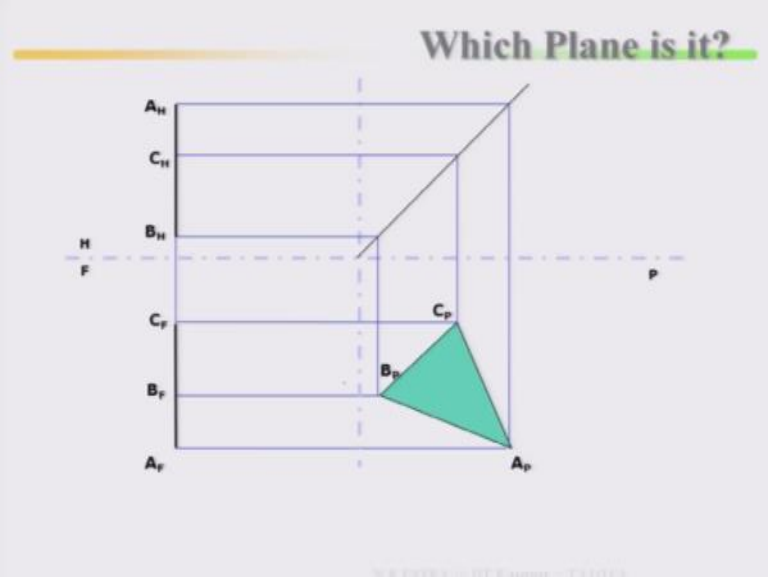

Next come to third one which plane is it look at it which plane is it, it is parallel to your profile, it is parallel to your profile plane, that means parallel to your profile plane.

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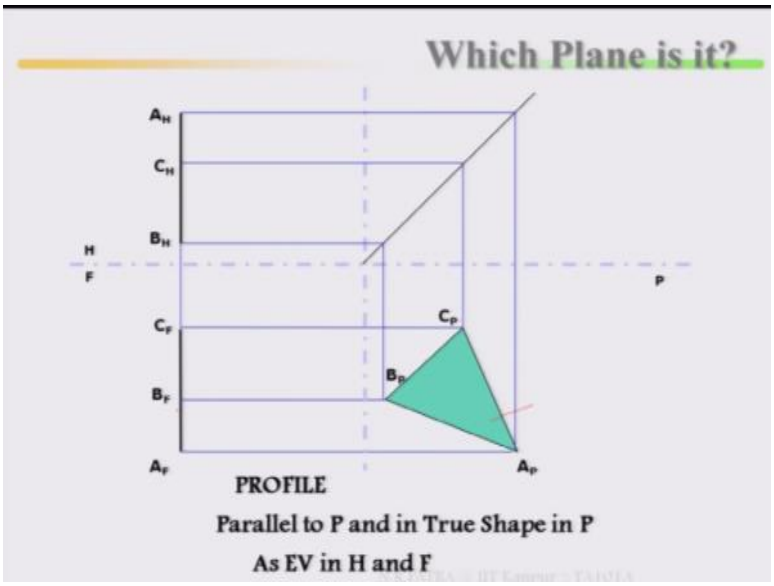

Means this part is your true shape, this is your profile, then parallel to profile it is in true shape in profile plane and as an edge view in frontal as well as in horizontal plane

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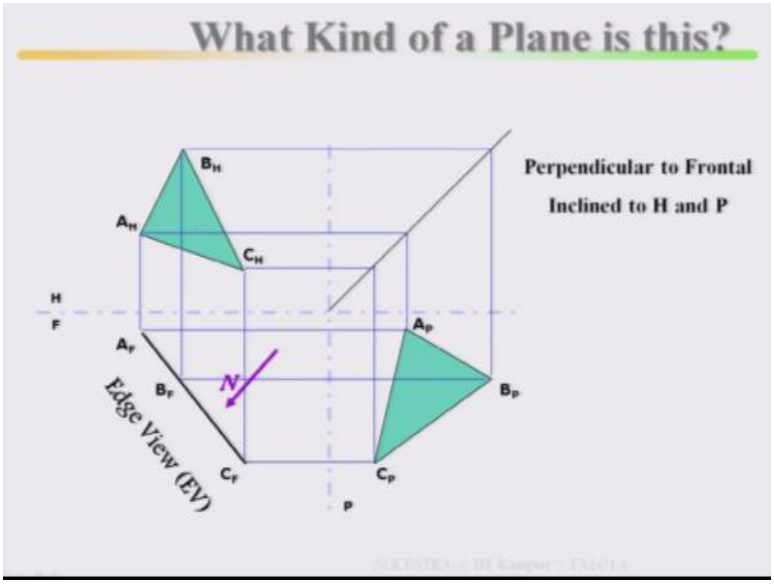

Then what kind of a plane is this, what kind of a plane is this, look at here what kind of a plane is this? Mark it, normal N has been marked here edge view and normal view has been marked, this is your true shape look at here, perpendicular to front inclined to horizontal and profile, it is perpendicular this plane is perpendicular to front that means this is your edge inclined to horizontal, inclined to horizontal as well as profile plane this is first one, perpendicular to your frontal where the edge view is there.

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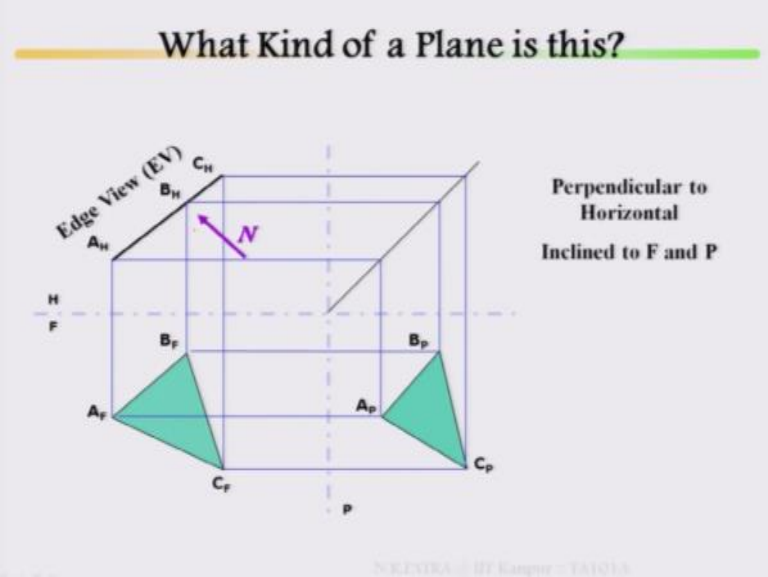

Then second edge view, edge view lying where, edge view is lying in your horizontal plane, that means this is perpendicular to your horizontal plane, inclined to frontal, inclined to frontal, inclined to profile.

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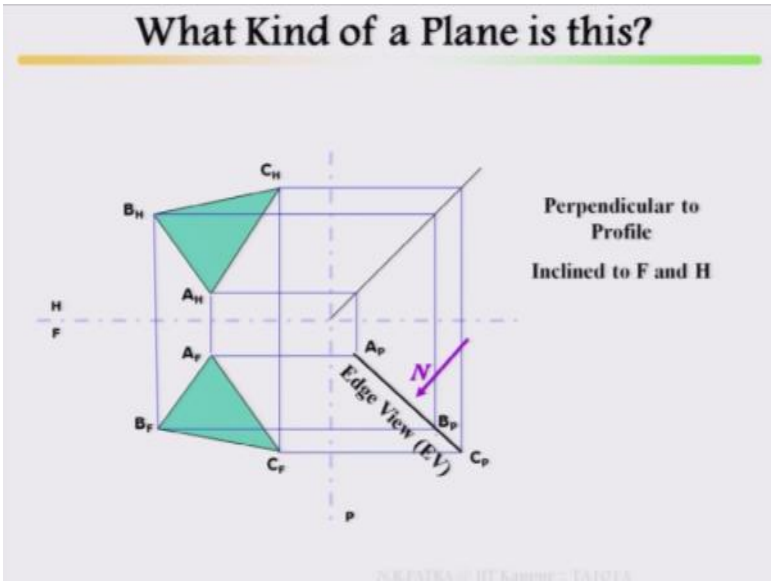

Similarly this is your edge view perpendicular to profile inclined to frontal and inclined to horizontal, perpendicular to profile, inclined to frontal and horizontal.

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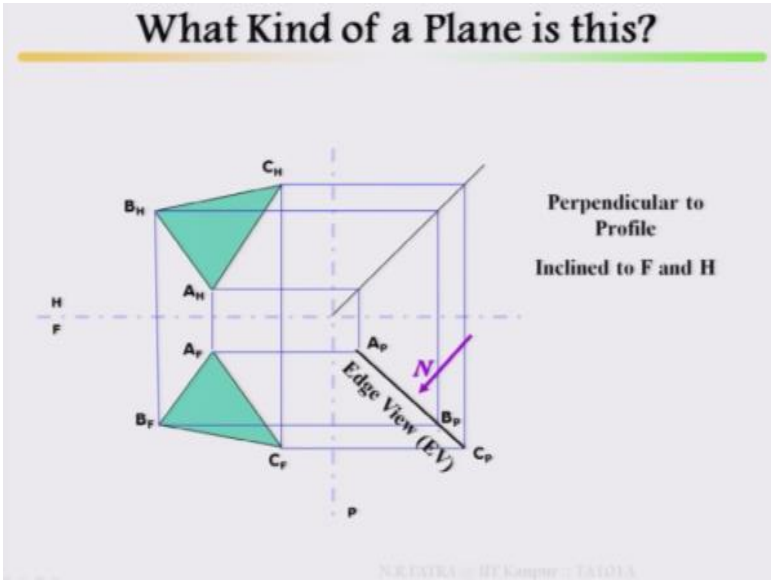

This is I am just giving one by one example.

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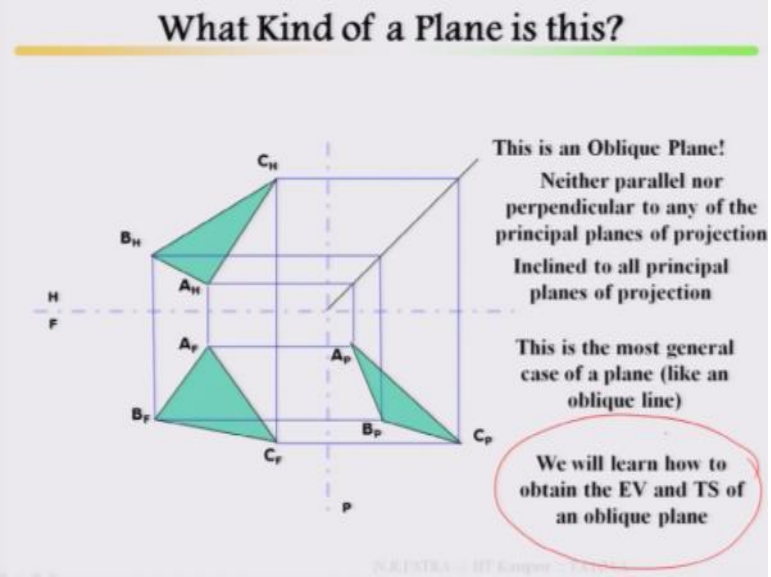

I will repeat it next class slightly so that before I go to the details in planes. Now look at this figure, what kind of plane is this, there is no edge view, this is an oblique plane. Oblique plane means neither it is perpendicular nor it is parallel to any of your principal axes or principle planes that means this is an oblique plane. As I said neither parallel nor perpendicular to any principal planes of projection, inclined to all principal planes or projection, this is the most general case of a plane like an oblique line, that means if it is oblique plane if I we are saying it is oblique plane that means neither it is parallel nor it is perpendicular to any of the principal pl*an*es. We will learn how to obtain edge view and true shape of an oblique plane, this is our basic requirement if there is oblique plane we have to learn how to get edge view, then how to get your true shape of the oblique plane.

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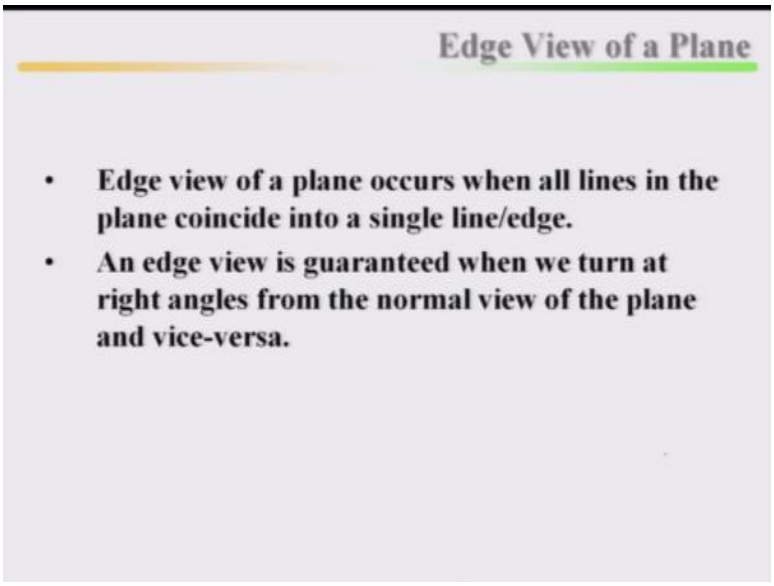

Edge view of a plane let us start with this step by step. Edge view of a plane occurs when all lines in the plane coincide in a single line, edge view of a plane occurs when all lines in the plane coincide in a single line or edge.

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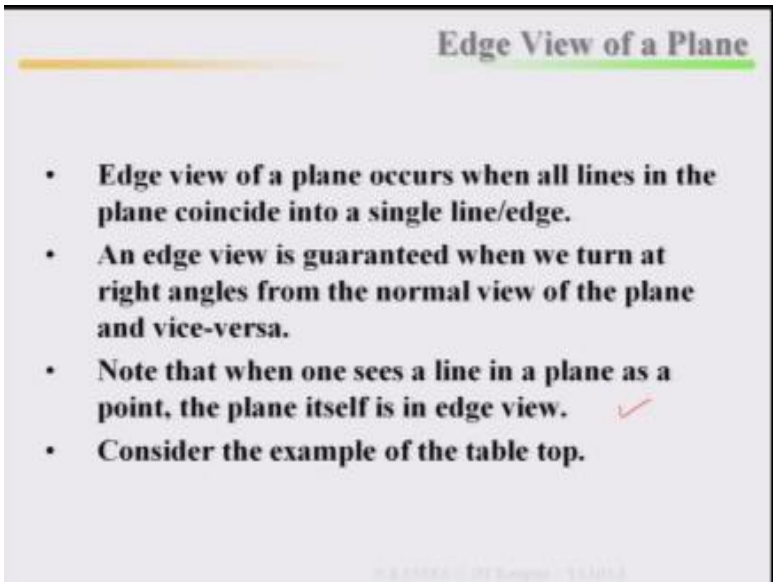

An edge view is guaranteed when we turn at right angles from the normal view, it is a guarantee when we turn right angle from the normal view of the plane and vice-versa. When one sees a line in a plane as a point the plane itself in edge view this is most important, when one sees a line in a plane as a point the plane itself is in edge view, consider example of the table at the top.

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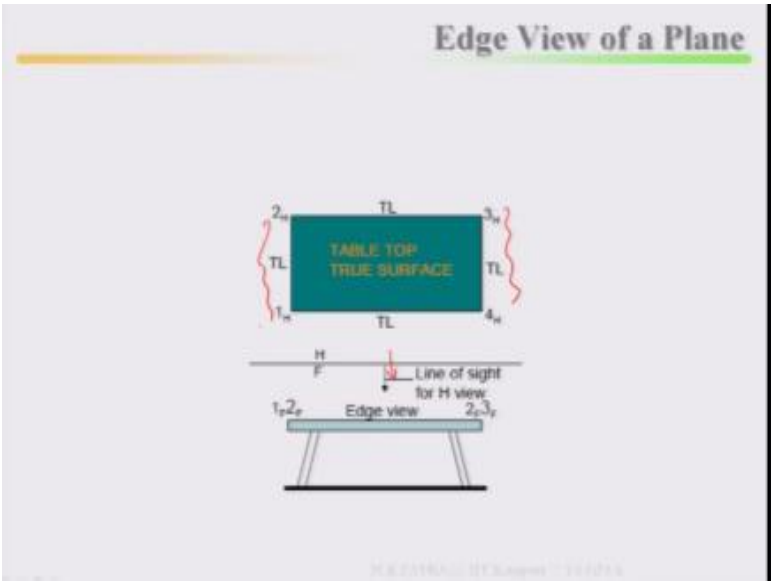

Look at the table, table top this is your table top this is in true shape, a true surface, why? This table top is parallel to your horizontal plane, now line of sight look at the line of sight how I am looking at the line of sight for the horizontal view. Now come to your front view line of sight is different. So what happen this will merge, this will merge, this become as a edge view, this is the best example you can see.

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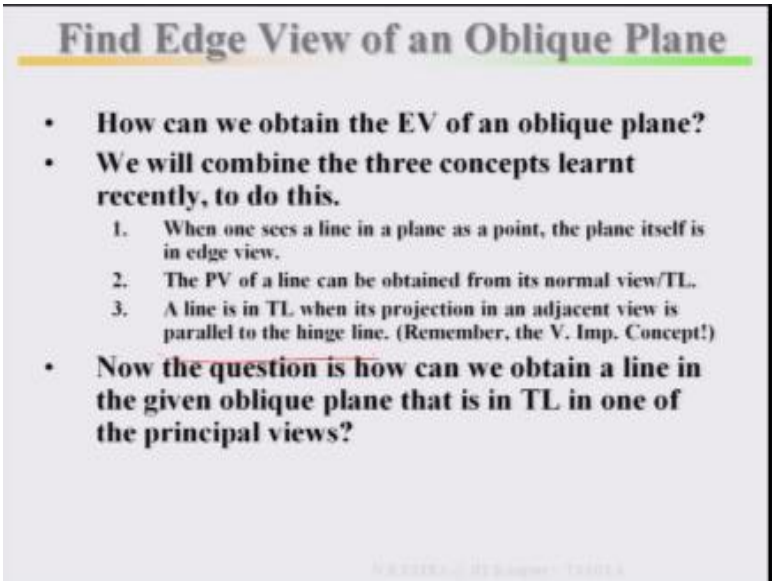

Find edge view of an oblique plane, how to get edge view of an oblique plane? How can we obtain the edge view of an oblique plane? This is the question once you get edge view then you can get your true shape of the oblique plane, we will combine the three concept to learn recently to do this, what is when one sees a line in a plane as a point, the plane itself is in edge view, when somebody see line as a point that mean the plane itself is in edge view, second the point view of a line can be obtained from its normal view or the true length.

Point view of a line can be obtained from its normal view or the true length, a line is in true length when its projection in an adjacent view is parallel to hinge line, when its projection adjacent view is parallel to hinge line, this is your important concept that means method of rotations coming, adjacent view is parallel to your hinge line a line is in true length in the opposite view.

Now the question is how can we obtain a line in the given oblique plane that is true length in one of the principle views, how can we get a line in a given oblique plane that is in true length? That means we have to convert entire plane to a hinge view that means a line, then from line we have

to find it out what is the true length, then from the once you get the true length of the line or the edge view, then you back trace it so that you can get true shape of a plane.

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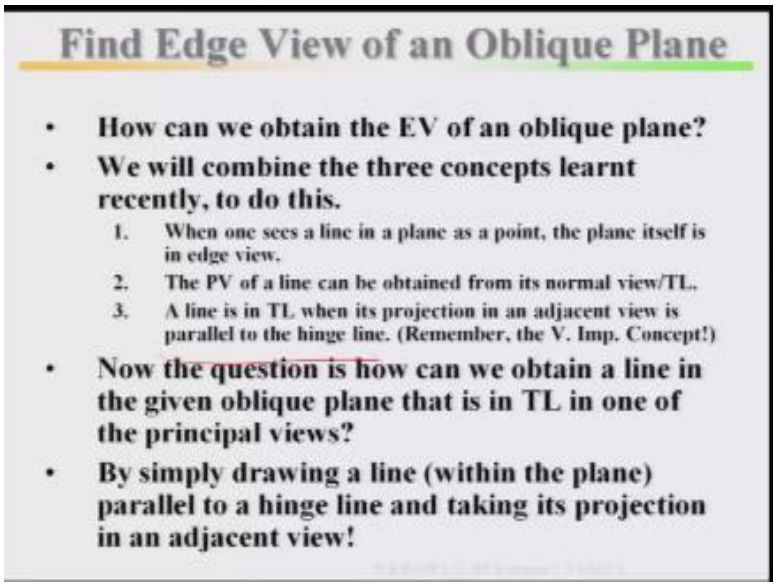

By simply drawing a line within the plane parallel to hinge line look at here, by simply drawing a line within the plane parallel to hinge line taking into projection in a adjacent view.

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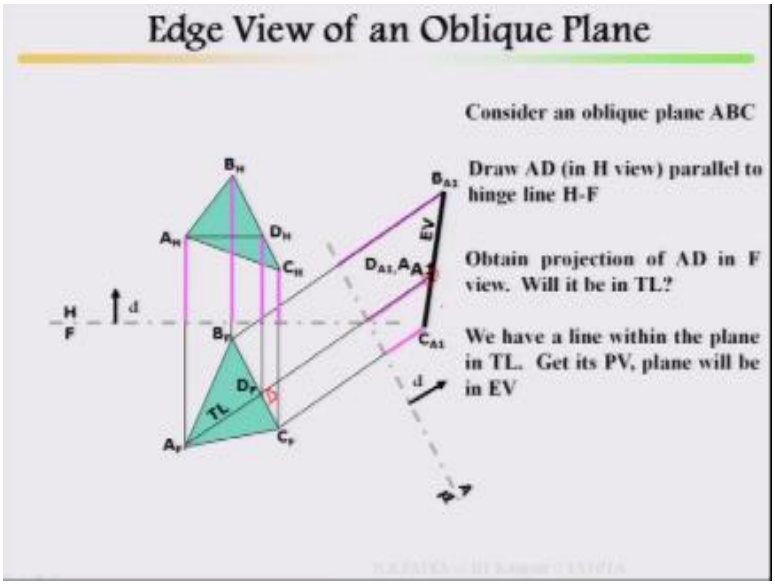

Now look at this edge view of an oblique plane, oblique plane in horizontal plane AH, BH, CH oblique plane in frontal plane AF, BF and CF, draw AD in horizontal view draw AD mark it, I just create a line parallel to the hinge line, in your horizontal view, either way you can do it, you can create a line CD parallel your hinge line in the front view I create a line AD which is parallel to your hinge line, then after projection of AD in front view.

Because once you are getting parallel to this that means whatever line you are going to get it as for your method of rotations that will be your true length, this has been projected back and this will be D and this is your DF and this is your true length, then we have a line within the plane in true length the concept is coming we have a line in the plane which is in true length, get its point view.

Plane will be in edge view, get its point view. So that automatically the plane will be in edge view. Now take it, now how to do it? You have to go for auxiliary view concept or auxiliary plane concept, this is your auxiliary view first auxiliary view, then same point of the D, if you are measuring distance from here to here we have to take opposite, what is the distance? That means this line we have to do.

How far this line, how far this line from this, this is your line take it, measure it this point, this distance, this point this distance, distance you measure it, plot it. So mark the points coordinates otherwise there will be confusion, where is your B, A1 in auxiliary plane, where is your DA1, AA1 and CA1? This is your edge view of the plane; this is your edge view of the plane. So this line this is your point view.

Once you get the point view at the same time plane will you will get the edge view, this is the concept. So then once you get the edge view, then you can get true shape of the plane.

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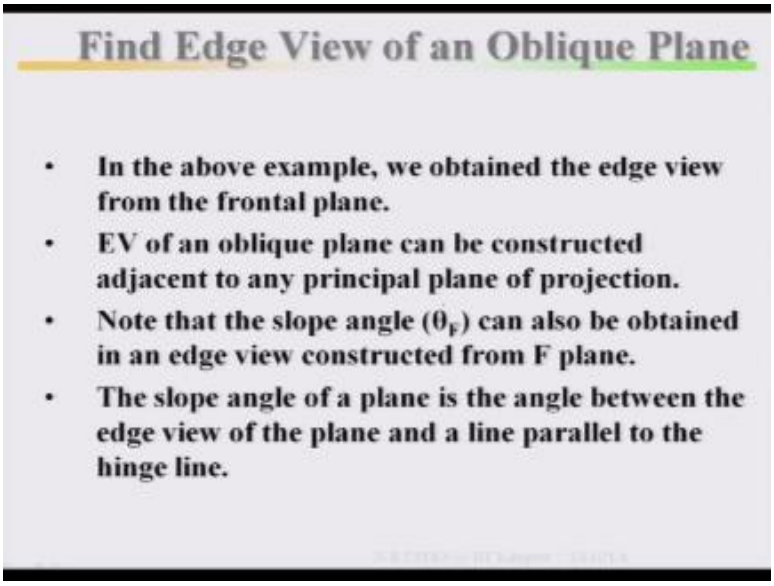

Find edge view upon oblique plane, we can summarize in the above example we obtained edge view from the frontal plane, right? Edge view upon oblique plane can be constructed adjacent to any principle plane of the projection, we got it edge view from the frontal plane, we can get it the edge view from the horizontal plane, we can get the edge view from the profile plane, that is the summary.

Edge view upon oblique plane can be constructed adjacent to any principle plane of projection, note that this slope angle θ_F can also be obtained in an edge view constructed from frontal plane, slope angle θ_F can be also obtained in an edge view constructed from frontal plane. The slope angle of a plane is the angle between the edge view of the plane and a line parallel to hinge line, and a line parallel to hinge line, this is the angle between hinge line or a line parallel to hinge line and the edge view, then you can find it out slope angle of a plane.

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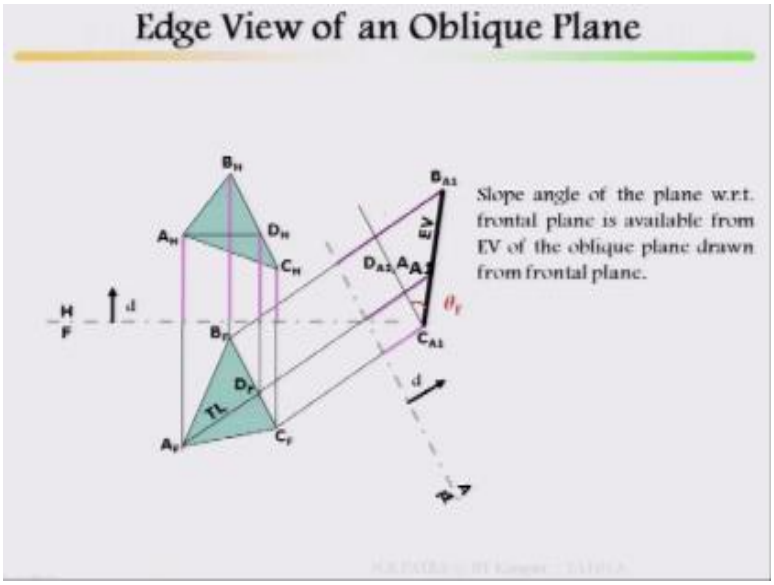

Look at here, if you look at here then this is your edge view then I draw a line parallel to hinge line. A line parallel to hinge line earlier example I am telling parallel to this hinge line then with respect to parallel to hinge line then this is your angle. This angle is your slope angle of the plane θ_F. Slope angle of the plane with respect to frontal plane is available from the edge view of the oblique plane drawn from the frontal plane.

Similarly, slope angle of the plane with respect to horizontal plane you can get it, slope angle of the plane with respect to profile plane also you can get it.

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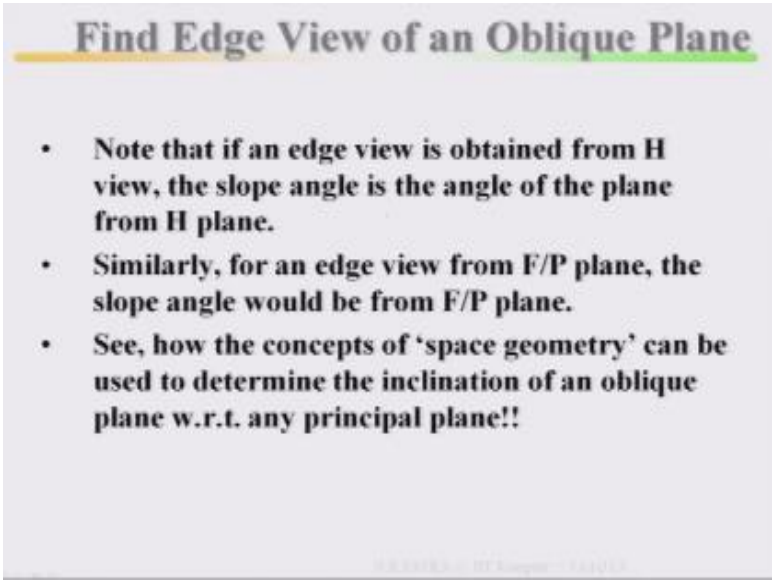

If an edge view is obtained from horizontal view the slope angle is the angle of the plane from horizontal plane. If an edge view is obtained from horizontal view the slope angle is the angle of the plane from horizontal plane, horizontal view not frontal view. Similarly, for an edge view from the frontal or profile plane the slope angle would be from the frontal and profile plane. How the concept of space geometry can be used to determine the inclination of an oblique plane with respect to any principal plane, this plane, oblique plane any principal plane with respect to how it has been inclined.

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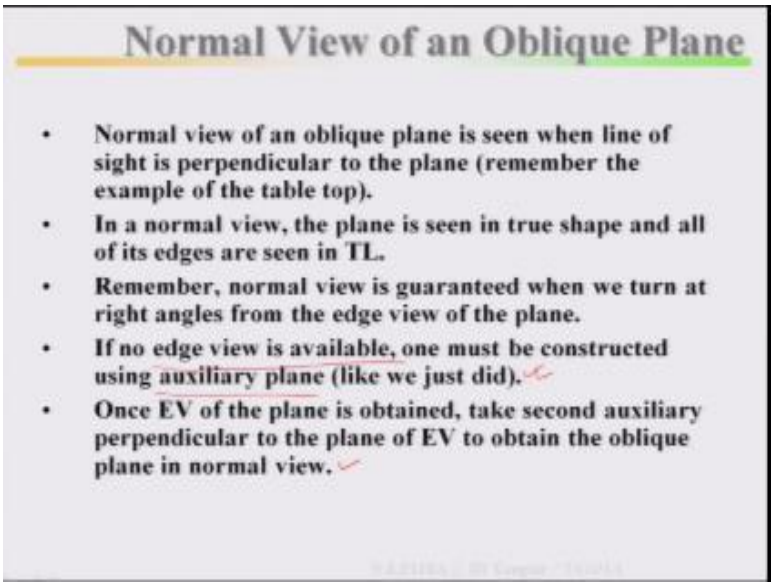

Normal view of an oblique plane is seen when the line of sight is perpendicular to the plane that is true. Normal view of an oblique line you can say that is seen when the line of sight is perpendicular to the plane. Then in a normal view the plane is seen in true shape, it is true and all its edges are seen in true length. Normal view is guaranteed when we turn the right angle from the edge view of the plane. If no edge view is available one must construct it using auxiliary plane.

If no edge view is available this is remember one must be constructed using auxiliary plane like with what we have done for lines. Once edge view of a plane is obtained then you take secondary auxiliary perpendicular to the plane of edge view to obtain oblique plane in normal view, remember this. Once edge view of the plane is obtained take second auxiliary perpendicular to your plane view of edge view to obtain the oblique plane in normal view.

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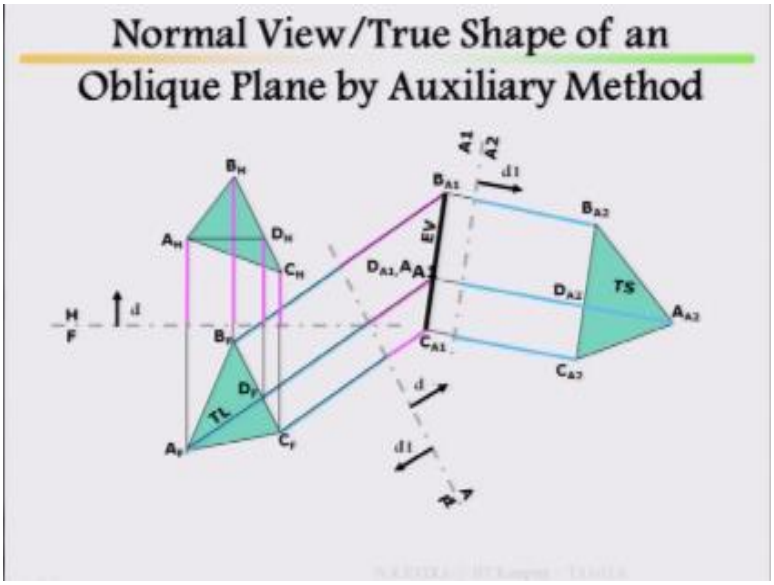

Now normal view and true shape of an oblique plane by auxiliary method. Horizontal plane, frontal plane, this is your plane A_H, C_H and B_H, B_F, A_F and C_F draw a line first parallel to your hinge line AD, then same line has been projected back in your frontal plane and A_F and D_F is your true length of the line AD in the top view, this is your true length of the line, then extend it then from there, from there you extend it other part, so draw a line in your top view AD parallel to your hinge line then respectively you get your true length in your front view.

This true length has been extended, with respect to your true length draw from B_F in the frontal and C_F parallel lines, draw it, draw it, project it back, draw any auxiliary plane at any distance, you draw it this is your auxiliary plane first auxiliary plane, and measure the distance opposite view. What are your points distance you mark it in opposite view from the hinge line, it will be the same distance and take it, and you will get edge view of this plane with respect to your frontal.

Then once you get the edge view then go to the another auxiliary plane. What I have said, then this is your second auxiliary plane and what is your distance you can take this auxiliary plane at any distance. What is the distance, this is d1 from where opposite view, it will be your opposite

view here, then take the distance, take the distance, mark it from there, mark it from there, draw your plane, this plane is in true shape. I will stop it here, next class I will discuss many more about the oblique planes. Thank you.

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