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

Lecture – 24
Space Geometry-Part-2
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So last class I have started with this basic introduction to space geometry an overview.

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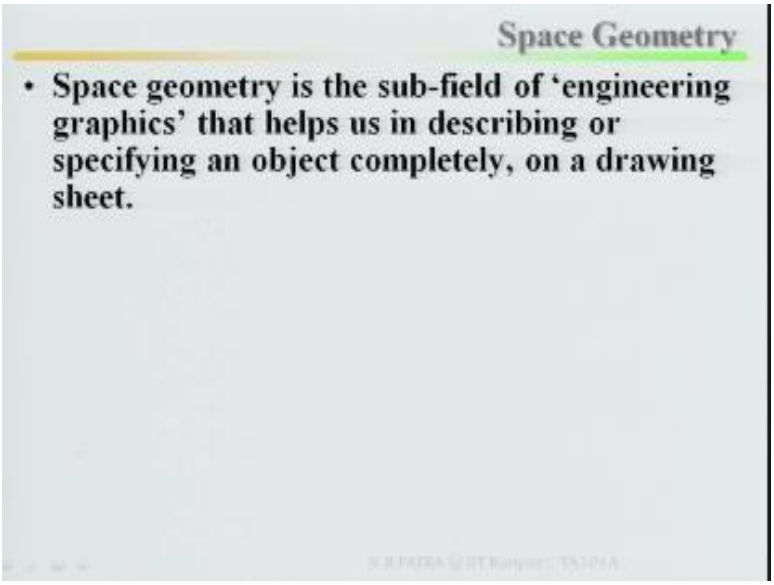

So space geometry is the sub-field of engineering graphics that helps us in describing or specifying an object completely either would describe or specify an object completely on a drawing sheet.

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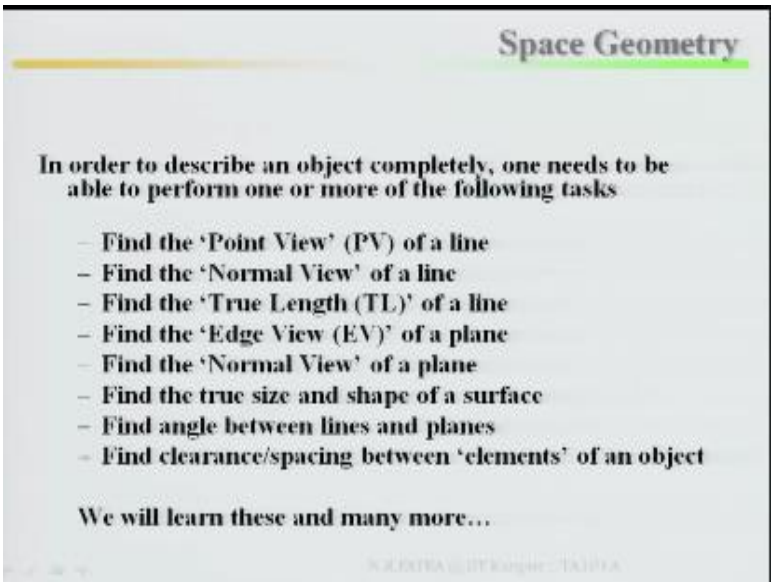

Basically one has to perform the following tasks, line in the space, plane in the space, intersection to line and plane, intersection between plane and plane. So in this regard you need to have to have find the point view of a line, find the normal view of a line, find the 2 length of a line, find the edge view of a plane, find the true size and shape of a surface, find angle between lines and plane in space, find any clearance or spacing between elements of an object.

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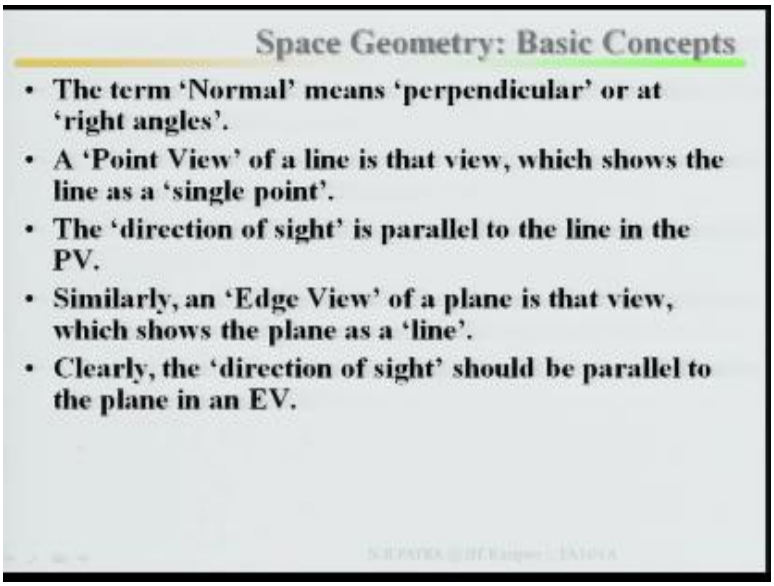

So some definitions, what is the meaning of normal, what is the meaning of point view, this I have covered.

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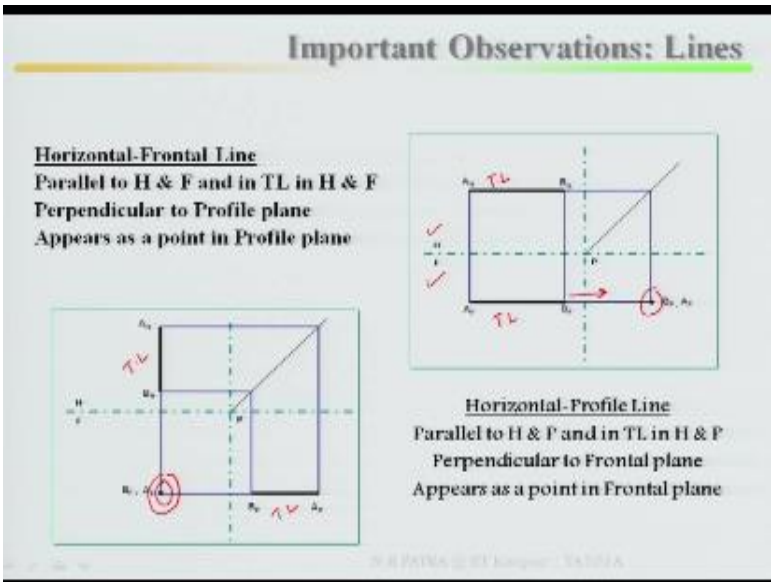

Then let us start with this important observations or important observations about the lines, horizontal and frontal lines, if I take it into 4 quadrant this is the horizontal plane, this is your frontal plane, and this is your profile plane, so horizontal and frontal line, horizontal and frontal line basically this is parallel to horizontal and frontal, horizontal and frontal line parallel to horizontal as well as frontal, in true length in horizontal and frontal perpendicular to your profile plane appears as a point in profile plane.

So particularly horizontal and frontal line if will look at here, this is your frontal, this is your horizontal, now both these cases lines are there in horizontal as well as in frontal, so because this is parallel to your hinge line these are in true length in horizontal as well as in frontal, so this is your true length, this is your true length, appears as a point, appears as a point in profile plane, if you look at here in profile plane appears as a point, that means I am looking in this direction definitely this entire line will appears as a point.

Appears as a point in profile plane. Now look at this line in horizontal in profile line if I say line is horizontal in profile line that means line is lying in horizontal plane as well as in profile plane, what does it mean, if line is parallel to your hinge line, if profile line is parallel to your hinge line

that means parallel to horizontal and profile, parallel to horizontal and profile in true length in horizontal and profile, that means line is parallel to horizontal plane, line is parallel to your profile plane.

That means in that case both this are in true length. However appears as a point in frontal plane, if I look at here from this side it appears as a point in frontal plane, if I am looking at here it appears as a point in frontal plane.

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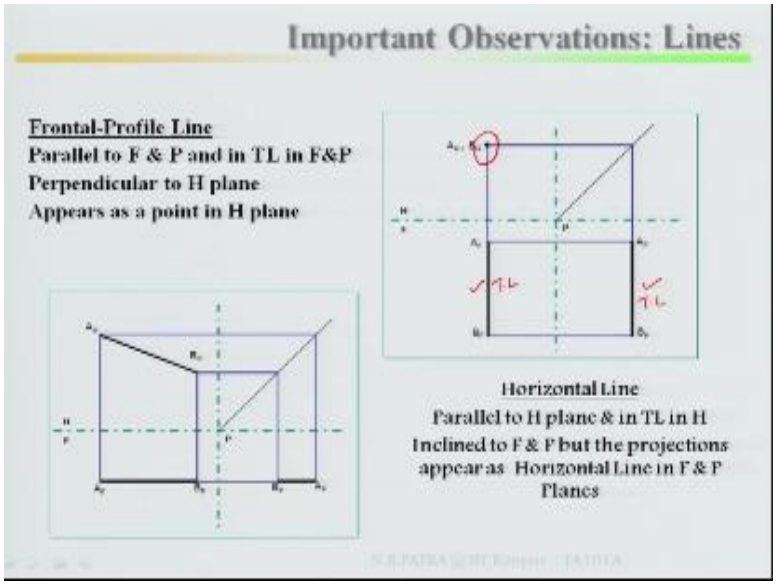

Similarly another two cases frontal and profile lines, similarly this is your frontal and profile lines, if these lines parallel to in frontal profile plane then these are in true length, so that is why this is in true length, this is in true length, so where is your point view? So point view will be lying in horizontal plane, point view is lying in horizontal plane, similarly horizontal line look at here horizontal line parallel to horizontal plane and in true length in horizontal incline to frontal.

And profile about the projections appears as horizontal line in front and profile planes, what is it mean? Parallel to horizontal plane it is parallel to horizontal plane, so true length in horizontal inclined to frontal.

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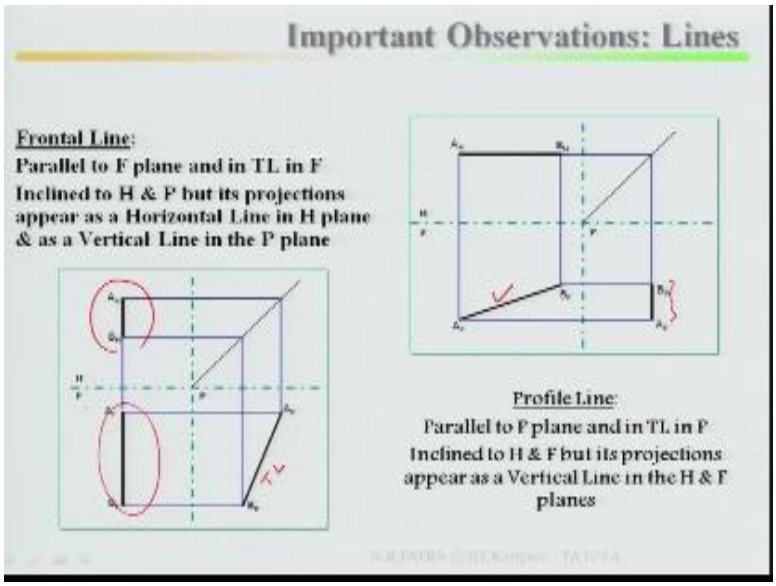

Now come to the next picture frontal line if I say it is a frontal line, if I say it is a frontal line that means what does it mean, if this line is a frontal line, this is your frontal line if I say parallel to frontal plane it is parallel to your frontal plane, this is your front plane parallel to your frontal plane and in true length in frontal, in frontal it is true length however it is inclined, inclined to horizontal as well as profile but its projections appears as a horizontal line in horizontal plane, as a vertical line in profile plane, it projections appears as a horizontal line in horizontal plane, it projections, if I project it back appears as a vertical line in profile plane, this is called frontal line.

Now come to the profile line same way, profile line is parallel to your profile plane and it is in once it is parallel remember if it is parallel to this that means whatever you are going to get it this will be in true length, that means this is in true length but it is inclined, inclined to horizontal and frontal, inclined to horizontal as well as frontal, so its projections appears as a vertical line in the horizontal plane, as a vertical line in the horizontal plane, and vertical line in your frontal plane.

These are all important observations about the lines, line maybe horizontal plane, line maybe frontal plane, line maybe profile plane.

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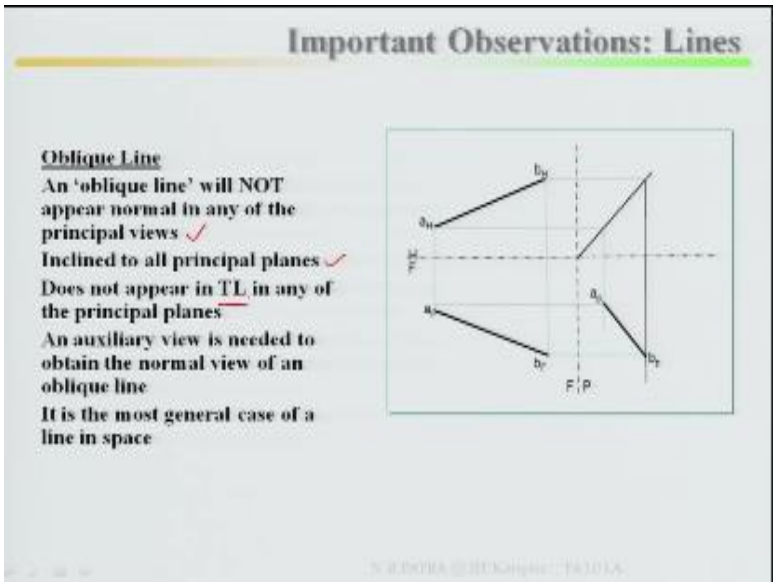

Now come to the next one, this straight lines parallel or slightly inclined, now if I say oblique line, an oblique line will not appear normal to or normal in any of the principal views remember an oblique line will not appear normal in any of the principal views inclined to all principal planes, oblique line is supposed to incline to all principal planes it is not parallel, does not appear, it does not appear in true length in any of principal planes and auxiliary view is needed to obtain the normal view of an oblique line.

An auxiliary view is needed to obtain the normal view of an oblique line, so it is the most general case of line in space particularly line in space you will get always or encounter oblique lines, so what are the features of the oblique line? An oblique line will not appear normal in any of the principal views, will not appear normal in any of the principal views, inclined to all principal planes, inclined to all principal planes, that means horizontal, frontal, profile, it is inclined to all principals planes.

What does it mean if it is inclined to, that means it does not appear in true length, it does not appear in true length in any of the principal planes. Then what will happen unless you are not getting the true length you cannot say that what is the length of the line in the space, so in that

case an auxiliary view is required or needed. To obtain the normal view of an oblique line it is the most general case of a line in the space, in general most of the lines are oblique lines.

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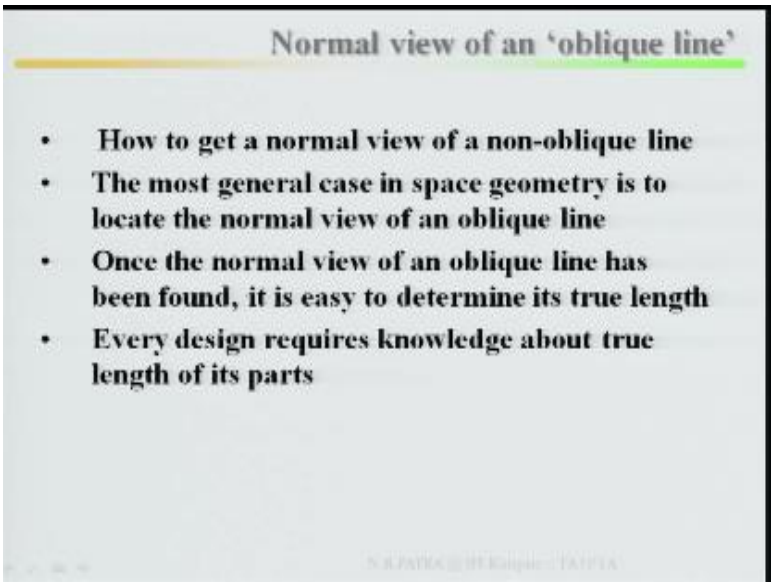

Now the question will be coming to you or to me, to everybody, how to get a normal view of a non-oblique line? The most general case in space geometry is to locate normal view of an oblique line, once normal view of an oblique line has been found it is easy to determine its true length. Once you get the normal view it is easy to find it out its true length, every design what is its implication, every design requires knowledge about true length of its parts whatever maybe the object.

It may be square, it may be rectangular, it may be triangle, it maybe rhombus, once it is in the space you should know true length of each parts, unless if you are not going to know the true length of the objects then how do prepare this objects? So true length of that particular line, particular length is highly important that is why this normal view is required.

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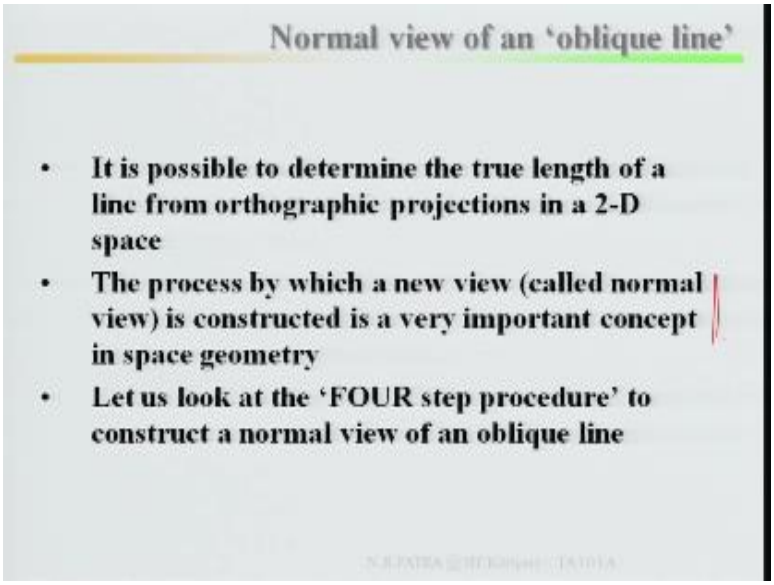

It is possible to determine the true length of a line from orthographic projection in a 2D space, it is possible to determine the true length of a line from Orthographic projections in a 2D space. The process by which a new view, the process by which a new view called normal view is constructed is a very important concept in space geometry, this is the part it will be newly introduced, the process by which a new view generally called we generally call normal view is constructed in the space geometry is a very important concept.

Let us look at 4 step procedures to construct a normal view of an oblique line, 4 step procedures to construct a normal view of an oblique line.

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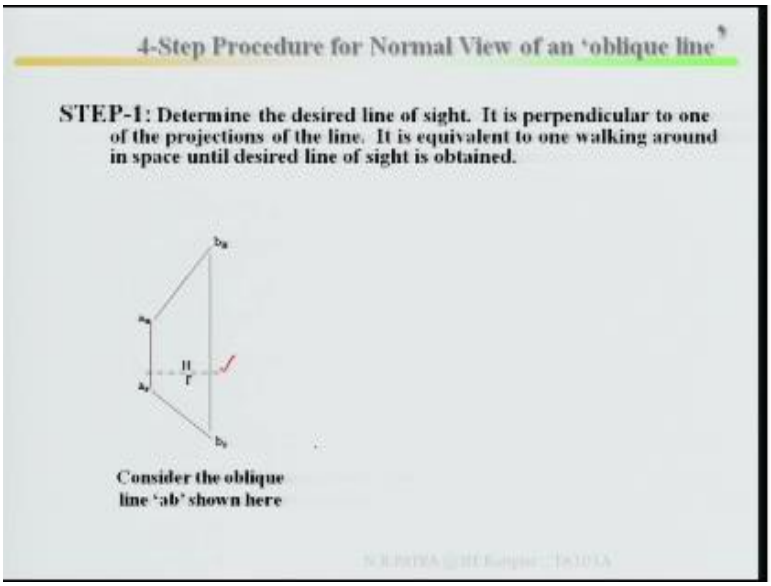

Step1, consider the oblique line AB so in here, if you look at here this is your hinge line, this is your frontal plane, this is your horizontal plane, so AH meaning AB is the line, if I am writing AH and BH it means Ah is lying, Ah means horizontal, H means horizontal, AH lies in horizontal plane. If AF and BF what does it mean, AF is meaning AB line or a point coordinate it lies in frontal plane. Determine the desired line of sight step 1, it is perpendicular to one of the projection of the line, it is equivalent to one walking around in the space until the desired line of sight is obtained.

You walk around the space until desired line of sight is obtained, I will show later on the 3D view. Now look at this, notice this line of sight H, BH, A, BF, what is your line of sight? You have to walk around in the space so that perpendicular to one of the projection of the line, so perpendicular to one of the your projection of the line, if this is the line perpendicular to one of your projection of the line.

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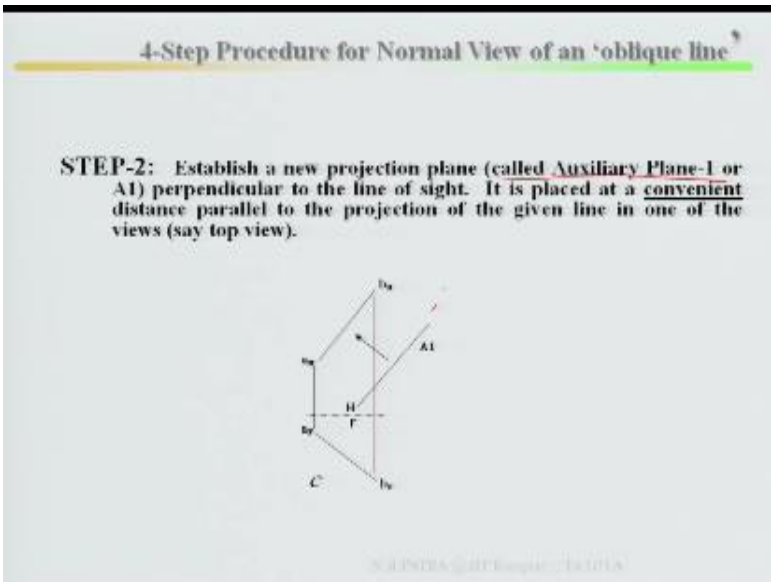

Now come to the step 2, establish a new projection plane called auxiliary plane one or A1, this is new thing, new projection plane it has been called auxiliary plane, auxiliary plane 1 that means A1, perpendicular to the line of sight, perpendicular to the line of sight, what is the line of sight, if this is the line look at here this is the line, I want to look this line of sight in such a way that there is a plane called auxiliary plane, it is perpendicular to your line of sight, if this is my line of sight then there must be a plane.

I can write it, it is A1 which is perpendicular to your line of sight so it is placed, now second point, second most important point, it is placed at a convenient distance, it is placed at a convenient distance parallel to projection of the given line in one of the views say top view. It is placed at a convenient distance if I draw A1 line perpendicular to your line of sight, A1 plane perpendicular to your line of sight so you can place I can place it here, I can place it here, I can place it here, here, here in one of the view.

Similarly if it is in the top view, in the front view what is your line of sight, if I am taking line of sight in this way then I can place auxiliary plane here or here or here. Remember this is perpendicular, this is perpendicular, now showing it now I hope I have just started I am not gone

in deep, I hope you understand the steps how your auxiliary plane concept has come, we want to look what is the true length of the line. Now placed at a convenient distance parallel to your projection line, so this is your A1 plane, auxiliary plane or A1 plane.

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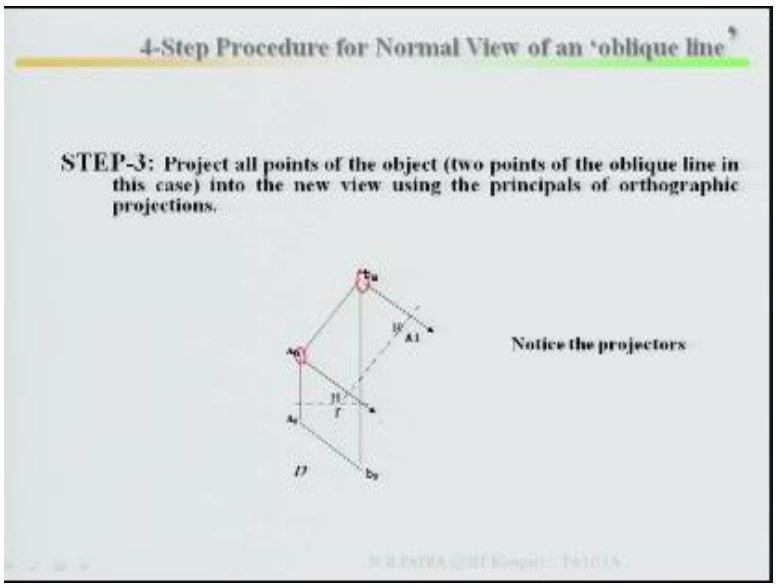

Now step 3 project all points of the object in a line, what are the points, 2 points of the oblique line in this case, into the new view 2 points of the oblique line in this case into the new view using principal of orthographic projections. Let us look at here, this is your auxiliary plane so from here I project it back, B point has been projected back, it has been projected back, notice the projectors, you notice this projectors.

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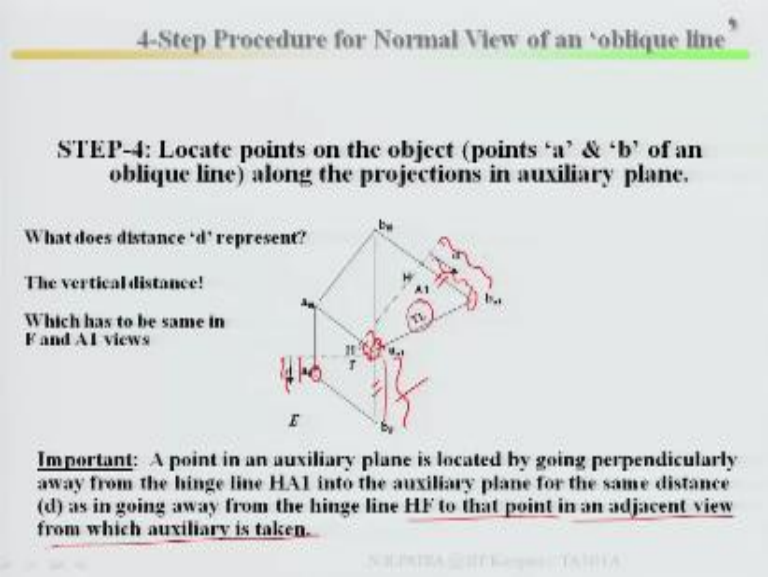

Then come to the step 4, look at points on the object along the projections in auxiliary plane look at here, locate points on the object along the projections in auxiliary plane, along the projections in the auxiliary planes. How this is AA1 why it is written AA1 and BA1, because A1 is your auxiliary plane, in that plane it has been drawn. A point in an auxiliary plane is located by going perpendicularly away from the hinge line, a point in an auxiliary plane is located by going perpendicularly away from the hinge line HA1.

Here away from the hinge line into the auxiliary plane for the same distance D as in going away from the hinge line in horizontal frontal to that point of an adjacent view from which your auxiliary is taken, look at here. Suppose you are taking this auxiliary plane here for this case what is the distance you are supposed to take it, these distance is your, in this case opposite view, this is your top view, this is your front view, what is the distance from here to here, what is the distance from here to here, these distance has been taken into considerations. I hope you understand from here to here distance, from here to here distance, this distance from this distance as well as this distance.

What is the distance, you have taken it back projected it back from here, projected back from here, then after your A1 auxiliary plane then how to locate this and this, this location of the point will be suppose this is A it will be distance from here to here will be distance from here to here, the distance of the opposite view from the hinge line. A from the hinge line what is the distance if this is D this will be D, if this is D this will be the D, now this will be your true length in auxiliary plane.

This will be your true length in auxiliary plane. What does distance D represent I have already said, so the vertical distance which has to be same in the front and A1 view, the vertical distance which has to be same in the front as well as, this in the front as well as in auxiliary view.

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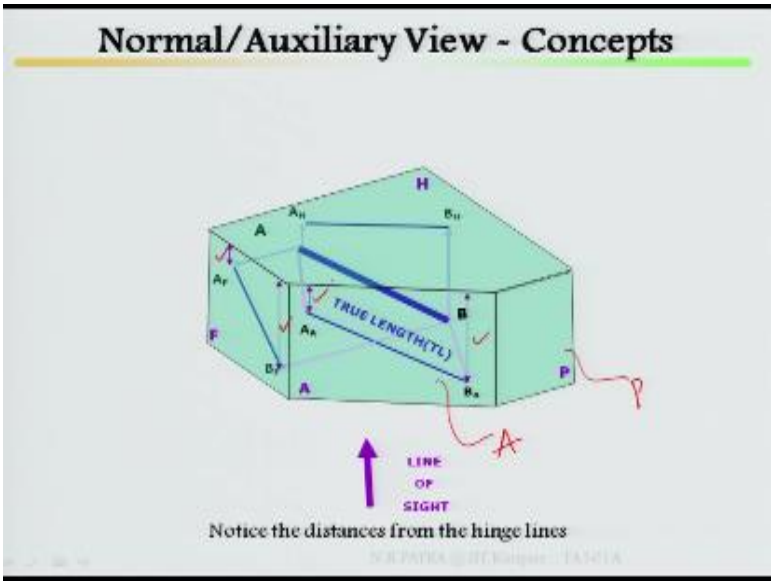

So normal view just going to the animation, normal or auxiliary view concepts, take a line AB, take a plane here frontal plane, B here then completely profile plane, then horizontal plane, this will be your horizontal plane, this will be your frontal plane, this will be your auxiliary plane, this is your profile plane. Now look at this, take it back so this projection in your frontal plane A_f B_f , now this projection in your horizontal plane A_H, B_H now I want to draw true length, with this line has to be come as a true length in auxiliary plane.

So this will be your A means auxiliary plane, P means profile plane, F means frontal plane, H means horizontal plane. True length appears to be in auxiliary plane so that means from here what is the distance you are going to take it, so major distance from the hinge line, distance from here to here, distance from here to here, same hinge line distance from here it has to be located. Now look at this animation, project it back, this distance project it back, this distance so this is your true length TL, true length.

Now line of sight, look at the line of sight. Now look at this animation, this is your distance A, notice the distance from the hinge line because these hinge line is continuing so the distance should be from the hinge line not from the object, your distance from the hinge line, your distance from the hinge line. So look at here it is the same distance this distance and this distance is same, this distance and this distance is same.

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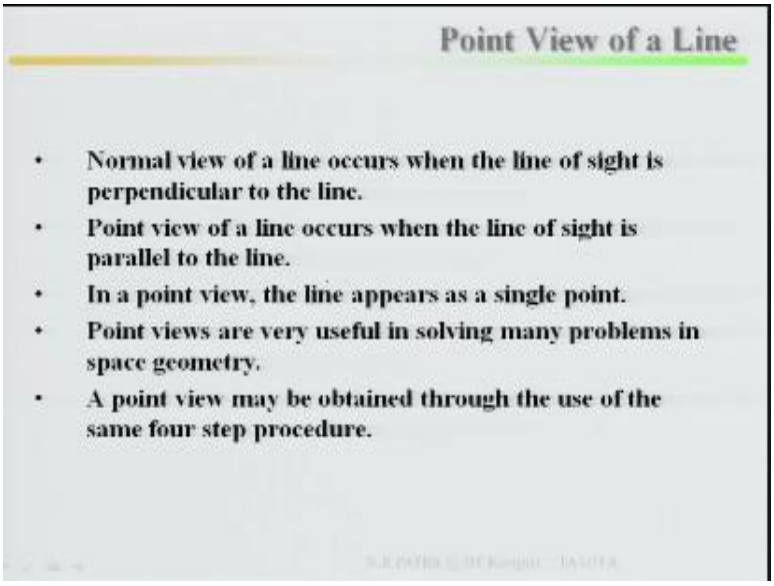

Now normal view of a line occurs when line of sight is perpendicular to the line, this is discussed. Point view of a line occurs when line of sight is parallel to the line, this is the difference. Point view of a line occurs when the line of sight is parallel to the line, in a point view the line appears as a single point, in a point of view the line appears as a single point, point

views are very useful in solving many problems in space geometry, a point view may =be obtained through the use of same four step procedures, whatever we have discussed same four step procedure point view can be obtained, so I will stop it here, in next class I will discuss more about lines, thank you.

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