Technical Arts 101
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Lecture - 21
Think and Analyze

So lines and planes interaction between them, intersection between them. The way they interact is bine section. So, this would be, I believe lecture number nineteen ((Refer Time: 00:37)).

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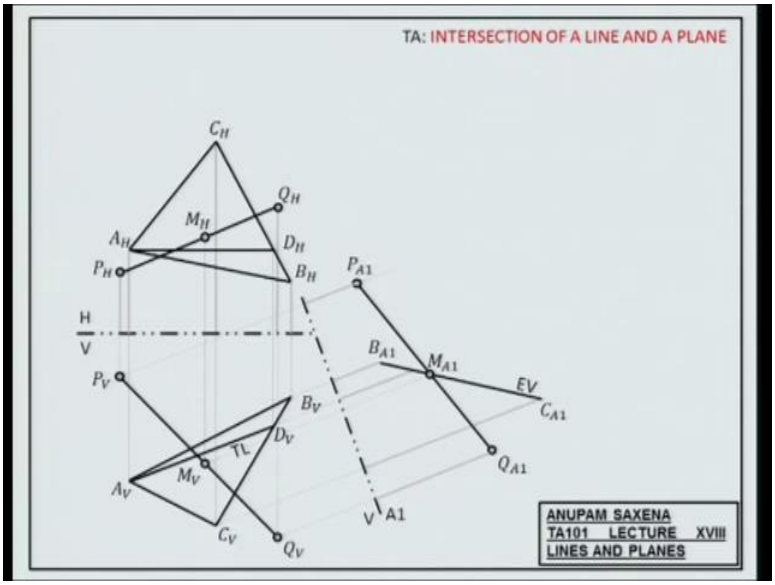

So given a line segment and a plane, and given the projections on a horizontal plane and a vertical plane. How do you figure, if these two entities intersect, would they? Just by looking at the figure, just by looking at the figure would they intersect? Would you know or would you not know, yes or no?

You would not know, okay, alright. How do you figure if a plane will intersect with a line or vice versa? You have the gadgets with you? We have the, Edge view? Somebody said edge view, no. How do you figure? If the plane and a line would intersect, no no. A plane, a line ok, now the best way to figure that is to see the entire scenario in the edge view of a plane. Take this plane, look at the edge view of the plane and see if the plane is intersecting with line.

The two possibilities, number 1 this guy is going to be piercing the plane, number two this guy is just going to be like that there would be a gap, yeah. If the guy is piercing we are lucky, but if there is gap we need to ensure whether we can do anything about this.

So, let us figure step 1 to look at the edge view of the plane. Draw horizontal that would be parallel to the horizontal hinge line. Mark D H on B H C edge, take its projection down, mark D V and so A V D V will be in true length make a hinge line perpendicular to that line A V D V shu the projections out and measure distances. That distance gets transferred over there, this distance gets transferred over here, and the third 1 gets transferred over here. And this is how you get the edge view of a plane.

Something which is quite cleared to you now ok, C A 1 B A 1. What would be here? A A 1 and D A 1. Alright, so both these points they will be at the same point in the edge view, why because these distances they are the same. So, this line is parallel to the hinge line, ok.

Alright, now do the same thing with the line segment P Q. We have the corresponding projection points over here p and q, shu the projections out, measure distances transfer it down there. So, that is your P A 1 measure that distance, that is your P A that is your Q A 1.

So, this is what you see in the edge view auxiliary plane of that plane of course. Now, would they intersect? You would not know, you would not know just by looking at the edge view, and just by seeing that the line segment intersects with the edge view of the plane over here. It does not necessarily mean that the plane is going to be intersecting with line and vice versa.

Let us see if it really does or if it really does not. So, the point of intersection there project that point backwards, of course this point is going to be lying where is going to be lying on the line, as well as it should be lying on the plane. Make sense, make sense? Alright, so project that point back M A 1 ok, it has to lie on the line. But is it lying on the plane? No. So, project it upwards it has to lie on the line alright M H. Is it lying on the plane? Would the plane and line intersect in this case? No, so that is the check that you would want to make. So, this point has to be a part of the line, and also it has to be a part of the plane number one.

Number two, these two points they should be lying on the vertical projection, right. Let us take another scenario. So, I will keep the plane the same, I will change the orientation of the line in both views, ok, brightness. You know the answer brightness the plane remains the same, the orientation of the line changes ok. The edge view remains the same because the plane remains the same ok.

Now, shu the projections from P V and Q V, measure the distance this 1. Transfer that distance over here projection out from Q V, that is p a 1 of course. Measure that distance and transfer it over there P A 1 Q A 1. Join P A 1 Q A 1. And you will have a point of intersection between the edge view of the plane, as well as this corresponding projection of the line. So, that is your point of intersection M A 1, transfer it back it has to lie on the line, that is M V.

And now you realize that the point also is within the plane. Take it up again, it has to lie on the line M H again it is within the plane. So, if you see these signs you know that the line and the plane, they are intersecting. Otherwise, they are not ok. Everybody, with me promise will have tea session Sunday everybody. Alright, was the answer to this question? Yes sir. Yeah, better.

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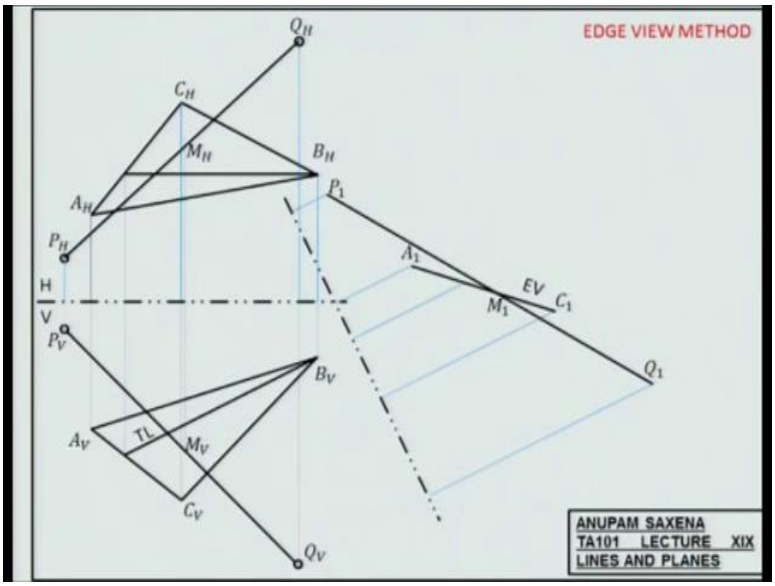

Another case and this is the edge view method, edge view method. Why? Because we are looking at the edge view of the plane, to figure out if the line in the plane are intersecting or not, horizontal line, the exercise remains the same. Horizontal line, take it down

trough length look at a plane which is perpendicular to this line of true length. Shu the projections out, measure distances, shu the projections out from all the five points the two points P and Q, and the three vertices of this plane A B C, measure distances transfer them, measure distances transfer them, measure and transfer.

Edge view of a plane mark the points, measure that distance from here to here, transfer that over there, measure that distance transfer that. And this is your corresponding projection of the line P 1 Q 1 ok. Point intersection M 1 transfer it back that point has to lie on the line that is M V, project it up again it has to lie on the line this is M H.

And of course, the true projections they lie within the plane. So, the line and the plane they would intersect in this case as well. When they intersect, what is that mean? A part of the line is going to be below the plane and the other part of the line should not be above the plane, right. Now, you got the point of intersections ok.

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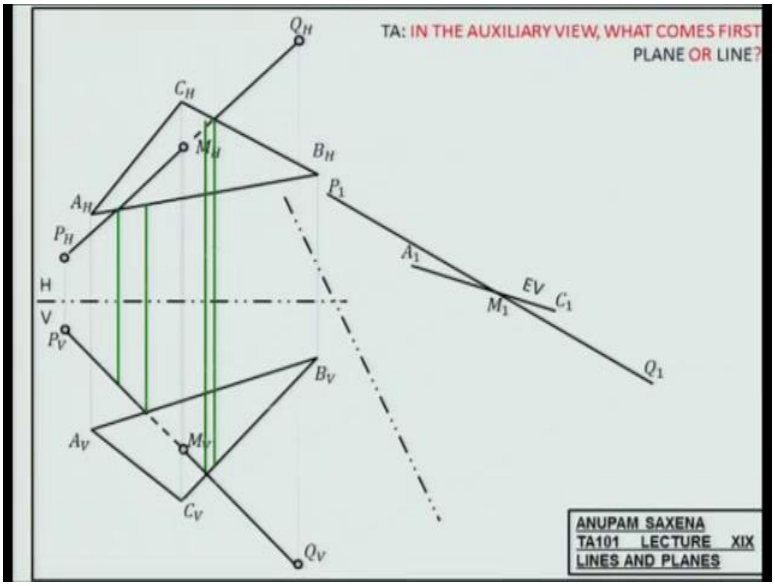

So, let us erase all the other parts and let me ask you a relevant question. Which part of the line is going to be visible in both views, and which part of the lines going to be hidden in both views? Once again, which part of the line? You know you looking at this segment, of course this part and this part it is going to be visible. Here, this part, and this part is going to be visible here, but here which part would be visible and which part would not be visible.

Likewise, over here which would be visible and which would not be visible. Would this be visible or, or would this be visible? Guesses, guesses, would this be visible, or this be visible? In the vertical plane would this be visible or this? Ha? Wanted to see the edge view, will come to that. Which edge view?

So what I will do is, I will tell you something about the projection method, it is a little veered, but works. So, stay with me, pay attention. So, the best way to figure what part of the line is visible or not is this, from the top view or from the horizontal plane. This line is intersecting this edge of the plane, and this line is intersecting this edge of the plane over here. Now, pay attention, follow the steps very carefully. What I would do is, I would drop a vertical from both these intersection points like for example, this 1, I drop a vertical. Now, in the frontal plane or in the vertical plane, what do I observe? Where would this projection or which part of this projection hit first, would be the line or would be the plane? In particular, would be the line P Q or would be the edge A B here.

Once again from this intersection point, I am going to be dropping a vertical ok, alright. And my question is that, vertical. What is it going to be hitting first, the line P Q or the edge A B in the vertical plane? The line P Q, if it hits the line P Q then implies that this part of the line is visible. Do not believe me? I do not expect to believe me, but I would say that this part of the line is going to be visible.

And, so I show that using a solid line. Now, coming back to that intersection point, if I drop a vertical from there now that point represents the intersection between P Q and B C the edge B C here. Here, the question I am going to be asking is, which is it going to be a line P Q? Or it is going to be the edge B C that that vertical is going to be hitting first, B C?

So, that would mean that this part of the plane is about the line. And, therefore, the line is behind this part of the plane. And, therefore, I would show this using a dashed line. I'll do the same exercise starting from this vertical plane. Points of intersection, that I need to consider is this intersection between P V Q V and A V B V and this intersection between P V Q V and B V C, B V C V. I raise a vertical from here go on to the top. What does this vertical hit first, A B? It hits A B first. That means what? That means what? This part of the plane is in front of the line. And, therefore, the line is behind that part of the plane and therefore, the line is dashed ok.

And, if I raise a vertical from this intersection point up. What is that going to be hitting first? Which line? P Q, so of course, P Q is above the plane. And, therefore, P Q is solid. Projection method, is it making any sense? Is it making any sense? Yes or no? Who says yes, the am I the, how is it making sense to you? Yah of course, yeah, but how do you verify? Ha?

The last vertical that I, no no no. So, look at this point here. This is the intersection point between P Q, and the edge B C. So, if you raise this vertical from here over there. The question that you are going to be asking is. Which is coming first the line or the edge B C of the plane? Not the plane, but the edge B C of the plane. So, I'll give you the clarification of this, and I'll come to the edge view, but this kind of works. And notice, what is happening at the intersection point? Two things are happening, number 1 at the intersection point a part of the line is solid and a part of the line is hidden.

Here as well as here, number 1. Number two, the part that is solid over here is hidden over here, and the part that is hidden over here is solid over here. Do you expect that, do you expect that to happen, yes or no? Is it going to be true in all cases? Are you sure? Would you like to T A about this? Think and analyze about this? Do that? Most of the examples that I have solved I have witness this phenomenon. Do This?

So, this is something very interesting. So, this part is hidden, the corresponding part over here in the other view is solid. This part is solid, the corresponding point, the corresponding part in the other view is hidden. So, the point of intersection, what it does is. It changes the state of that corresponding line segment solid to hidden, hidden to solid. Make sense, make sense, ok? Now, I think if I need to justify this projection method works, I have to look at the edge view ok.

This is the edge that we had drawn before. Now, you just focus on this part. This is the edge view of a plane, this is the line this is the intersection point. Now, focus on this region, focus on this region. What is in front? Is it the part of the plane or the line? Is it the part of the plane or the line? Which is in front? You guys are tired? Is it warm? Ha. Did you have heavy lunch? Yes? Come on, stay with me. Which part?

So, here is the part of the plane in front of the line or it is the line which is in front of the plane, in front of the plane. So, you are looking from here. So, this is your direction of view. Is it the plane that is in front? Rather, let me ask you slightly different questions.

So, is it the plane that is closer to the hinge line or is it the line which is closer to the hinge line? The plane is closer to the hinge line. What does that mean? From here to here, the plane is going to be hiding, the hiding the line behind it. From here to here, the plane is going to be hiding, the line behind it. Do you see that? Do you see that there were supposed to be two more points over here, we are not they or here.

I drew the horizontal from here, took this down took the edge view of that, yeah, somewhere over here. Do you agree? So, from here to here, the plane is in front. So, this part of the line is going to be behind the plane from here to here. The plane is going to be hiding the line and, therefore it is hidden. From here to here, the plane is behind the line.

Here to here, plane is behind the line and, therefore this part of the line is solid. Make sense, make sense? Yes or no? Good. Can you do the same thing for the top view? You have to draw the edge view over there. Yeah, and if you believe that, this reverse of happens. Once you figure this thing out, go over there, this part is going to be solid, this part is going to be hidden and you are d1 if you believe that, yeah.

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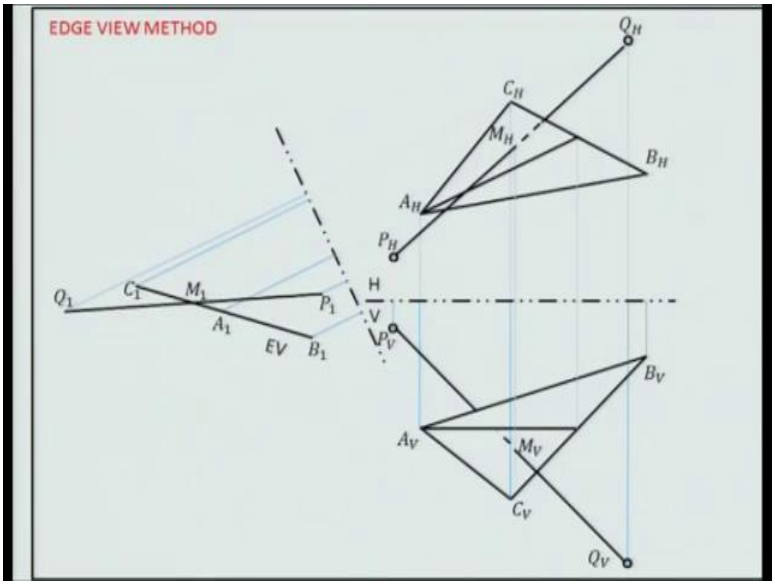

Another example, plane and a line edge view method horizontal. You know, by the time we are d1 with the lines and planes, you guys are going to be so adept with this method that while you are sleeping you will be like, yeah. Horizontal line, true length, you know horizontal line, true length hinge perpendicular to the line of true length, shu projections

out, measure distances from where bottom or top measure distances, from bottom transfer distances.

Is my screen shaking? Get the edge view of the plane, mark the points on the plane get the line in there. Well, that is the same example which is at I am now focusing on the edge view of the plane, from the horizontal, horizontal plane. Now, here the question is, of course, points of intersections M 1 M V, M H.

Ok, here, from here to here. Which part I mean, what is closer to the hinge line? Is it the line or the plane? Line, line is closer. So, from here to here, what is your corresponding part there? M 1 to be 1 M 1 to be 1 from here to here, right, from here to here. Which part of the line is going to be hidden? Which part of the line is going to be solid? So, the line is closer to the hinge line there.

Do you expect that to happen? Do you expect that to happen? Because, the line is closer, so the plane is behind the line and therefore this is dotted. And if you want to come down, this part is solid so this part has to be hidden and the other part has to be solid, yeah?

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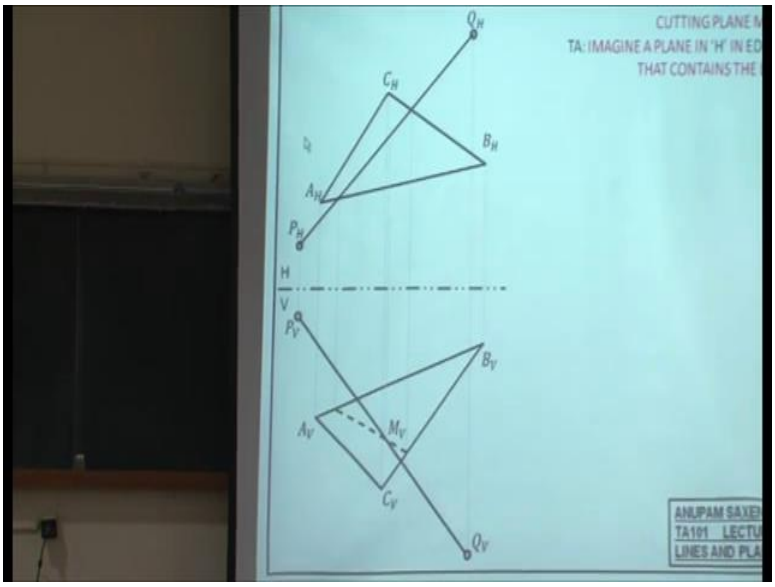

Cutting plane method, imagine a plane in the horizontal plane in edge view that contains the line P Q. So, you have a plane here that is slicing this plane A B C, and that plane is

containing the line P Q. So, imagine a plane in the edge plane that contains a line P Q and that slices A B C, alright.

How would that plane slice the plane A B C, in the vertical plane? Or the frontal view? Look at this, point drop a vertical down there, so this point lies on A B. The point has to lie on A B. Look at that point drop a vertical down there this point lies on P Q and it point it also lies on B C.

So, we are interested in that plane intersecting with the plane A B C and, of course two planes intersect to give you, what? A line, so this is the where the impression of that line is going to be. That line is going to be intersecting, the line P Q, of course this would be the point of intersection M V, project it up to get M H, once again, once again, alright. I am half asleep already. Plane A B C in the top view, double a come up in stage. Now, did you get this t shirt printed before the galaxy results were announced or after the galaxy results were announced?

Student: sir, before.

They got this t shirt printed before the, this last year. So, these scores they are not the true scores, yeah. They are from the last year. 717715706. What is that? What is this arrow signify? No got the arrows pointing downwards. It is not a good idea, na? So, it shows borrowings are going down. Well good idea for some not a good idea for others. Where am I?

Alright, so plane A B C hold this line P Q hold this, and so this is the horizontal plane. So, imagine that a plane that is containing the line, it is intersecting with the plane A B C. Plane containing the line is intersecting with the plane A B C hold the line. Now, this, what the scenario is flip it by ninety degrees, yeah, thanks.

So, imagine a plane which is containing this line flip this by ninety degrees. So, you have got two points of intersection, one over here the other one over here, project these points intersection down. So, the plane is going to be intersecting with A B intersecting with A B and the plane is going to be intersecting with B C. It is going to be intersecting with B C. Here, two planes, when they intersect they give you line of intersection, this would be the line of intersection between the plane which is containing the line P Q here and this plane A B C.

Alright, and the intersection point between the plane and the line P Q has to be common to both P Q and this dashed line, which is this, here. M V project it upwards the intersection point has to lie on the line P Q. This is M H simple. In the previous case, if the line and plane would not have intersected, would you have expected intersection to be happening here it would be happening outside the plane?

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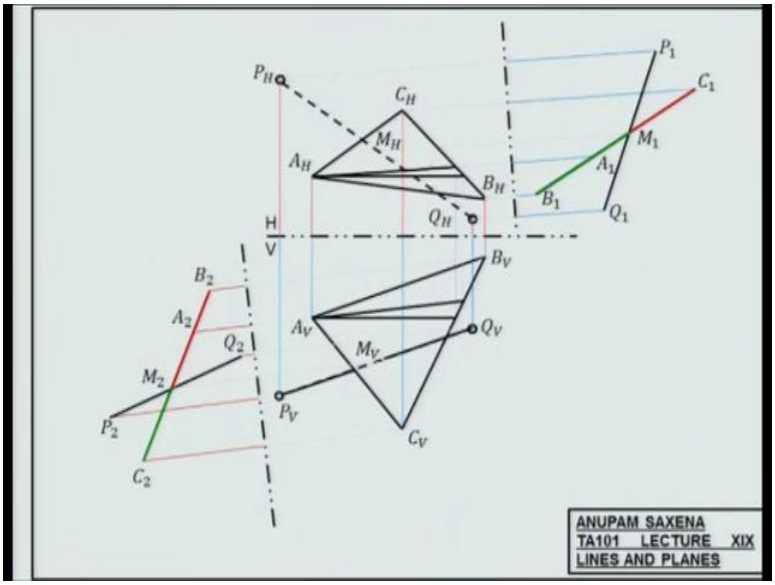

Stay with me, alright. I have no idea what I am doing, but let see horizontal line true length edge view of the plane A B C, projectors from P and Q out measure distances from the bottom view transfer distances on the auxiliary plane, get the edge view of the plane mark the points on the plane get P Q also.

Alright, so that is your point of intersection M 1, project it back on to the line P Q that is M H, project it down that is M V, that is alright. Now, if you take a horizontal line here get the true length, here get the edge view of the plane using this as the helping view. The same exercise, get the edge view of the plane there and, of course the corresponding projection of the line.

Now, look at this point of intersection here, look at that point of intersection over there, should they be giving you the same result? They should be giving you the same result. Otherwise, the views will be lying which is not a good idea so M two correlate with M V, and of course M H correlate with M V, ok.

Now, if you do not want to follow the projection method to figure out the visibility of P Q, we can simply use the auxiliary views. So, if you do not want to use the projection method, to figure out the visibility of P Q and, if you just want to use the auxiliary views then do this. Figure whether the line is closer to this hinge line or the plane is closer to the hinge line. Here, the plane is closer to the hinge line. So, that part of the line will be hidden. The rest here corresponding to this part of the plane which is behind the line that part is going to be solid.

Once again once again alright question. What is closer to the hinge line the plane or the line? Here, the plane so this part will be above the line and this part of the plane will be below the line. So, the corresponding part from here to here will be solid from here to here will be hidden go on to the top and ask the same question using the auxiliary view. Here, which part is closer, the plane or the line?

The plane is closer right from here to here, the plane is closer. So, which part of the line will be hidden, the bottom part or the top part? The bottom part, the bottom part will be hidden, the top part will be solid, and the switch has to be at the intersection point. So, keep that in mind the switch between hidden and solid it has to be at the intersection point otherwise does not make sense. Now, if I do the same thing using the cutting plane method, I hope I am doing that, no no. Well, I am doing projections that intersection point and this intersection point I drop a vertical from there P Q and A C over here, which comes first P Q or A C? P Q.

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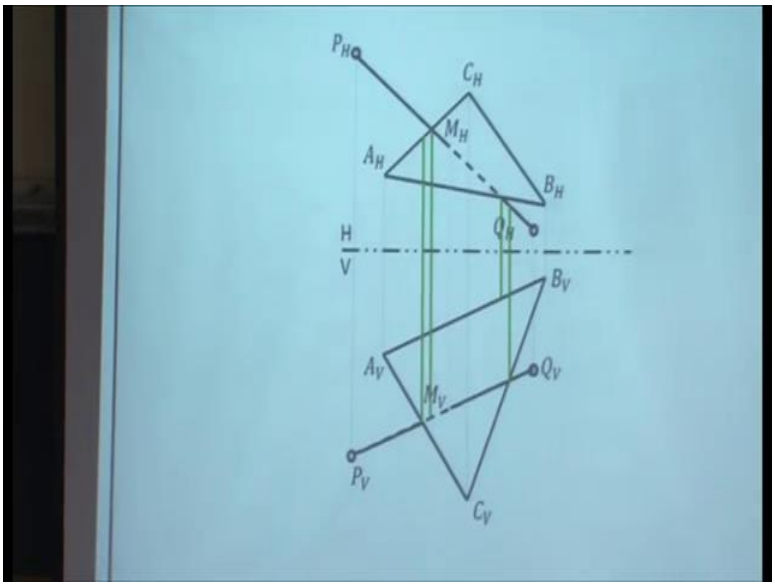

P Q, yeah, P Q comes first. So, what part of the line will be solid there? What part of the line will be solid there, this 1, or this 1? Yes, get a Q. Remember this? Yeah, I guess you could do that right. So, projection method is not very difficult so get the vertical line. Figure that P Q is above A C.

So, the P Q will be solid from here to here, and the rest will be hidden. And do the same thing from the bottom, raise a projection line from here. So, this is the intersection between P Q and A C, A C comes first. So, this part of the line will be hidden and the other part of the line will be the other part of the line will be solid, right. So this is a nice ((Refer Time: 38:12)), but the auxiliary view method, the edge view method gives you a reason as to why a part of the line will be solid the other part will be hidden or vice versa.

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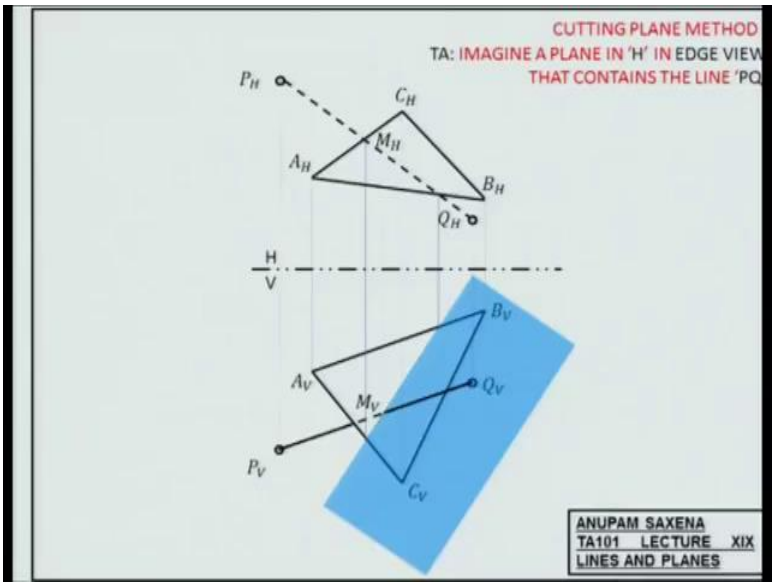

Cutting plane method, a plane which contains a line P Q here in the edge plane assume that, it is intersecting the plane A B C get this point down over here, get this point down over here. This will be the line of intersection between that imaginary plane and the plane A B C that line of intersection the blue dotted line is going to be intersecting the line P Q here. So, you would realize that m v and m h they are the same points whether you use the auxiliary view method, edge view method or the cutting plane method they would have to be the same.

Now, ask yourself this and this going to be a tricky question, ask yourself this and this going a be a tricky question. So, if I am having a plane here that is containing the line P Q. I have that plane is going to be intersecting with this plane A B C, here, which part of the plane A B C will be in front of this plane and which will be behind? Once again, if I have plane here containing P Q and if this plane is intersecting with the plane A B C which part of A B C will be in front of this plane and which part of A B C will be behind this plane?

Think about that, think about that and in particular, if you flip this scenario and come back to the vertical plane what happens then. So, that imaginary plane, the light blue is behind the plane A B C, the dark blue is in front of the plane A B C. This guy is behind A B C, this guy is in front of A B C, I believe. So, A B C is, is in front of the line in the light blue area and behind the line in the dark blue area.

The same thing from the frontal side, imagine a plane which is containing P Q here. It intersects the plane A B C. How do you find the point of intersection? Raise the vertical from here to here, raise another vertical from here to here. That is your line of intersection between that imaginary plane and the plane A B C and, of course this is your point of intersection.

So, whether you start from the horizontal plane or the vertical plane it does not really matter and again if you ask the same question, which part of the plane will be I front of this imaginary plane, and which part of the plane will be behind the imaginary plane? It is something that you need to think about, so the light red part is behind.

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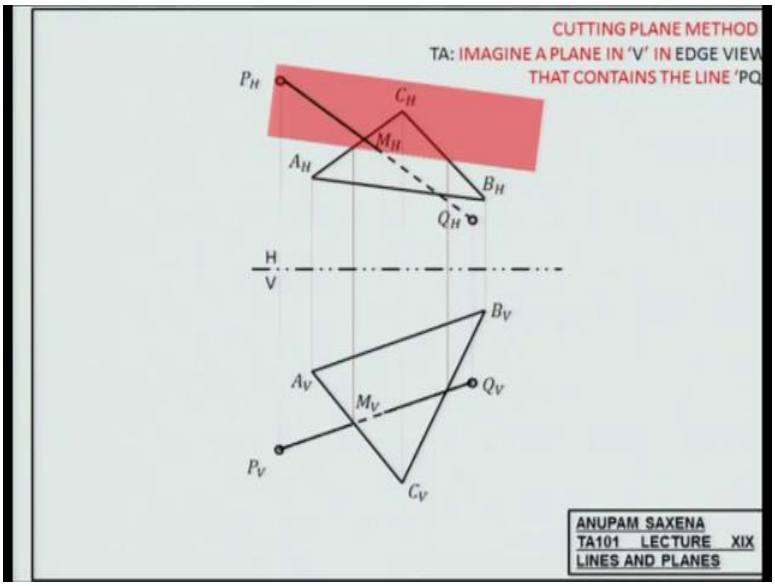

The dark red part is in front, so which part of the plane is in front of this plane. So what will happen to the line? What happen to the line, that think about this? Questions? Zombie.