Technical Arts 101
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Lecture - 36
Lab – 08

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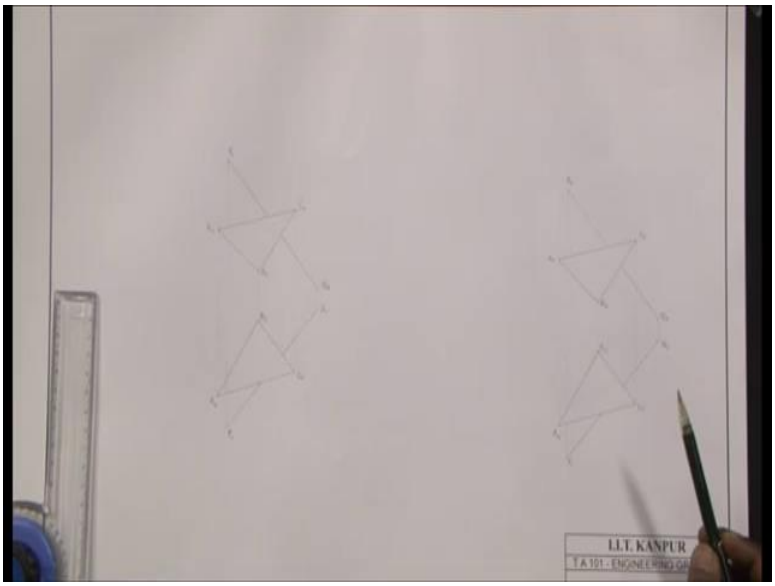

Today will draw details on the interaction between planes and lines. Interaction involves two aspects, which we would address, number 1, what would be the intersection point between a line and a plane and number 2, which part of the line will be visible within the projection of the plane. So, if you notice these are two identical pictures we are going to be discussing two methods, one is the edge view method that will be working over here, the second one is the cutting plane method that will be working over here. Now, both these methods will help us determine the intersection point between the plane and a line as well as the visibility of the line.

So, let us start with the edge view method first or the auxiliary view method first. So, this is the projection of the plane, on the frontal view or the frontal plane, this is the projection of the plane, in the top view or the horizontal plane. Likewise, for the lines same over here and the question now is to determine first, the intersection between the line and a plane, if they are exists one, so what we will try to do is we try to first figure the edge view of this plane.

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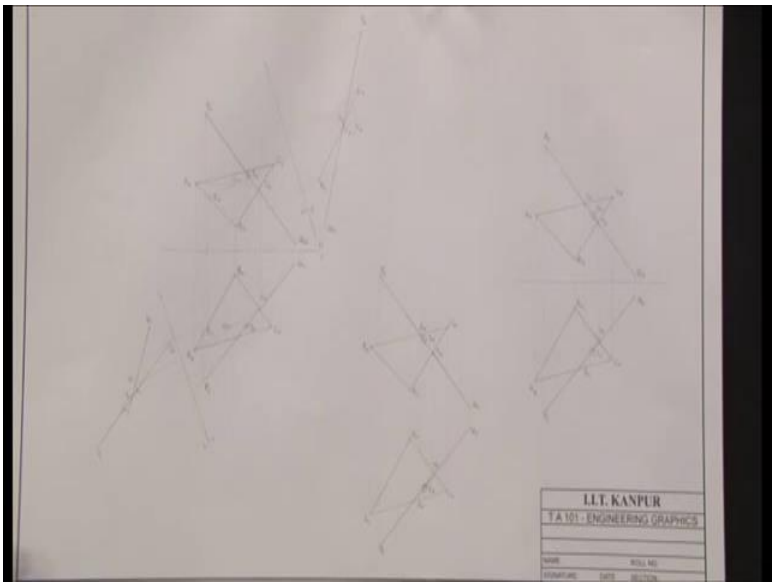

Now for that, let us start with the hinge line in between these two views switch my pencils, it could be anywhere between these two, you know what the code for the hinge line is a long dash followed by two short dashes. The trick to find the edge view of the plane is to identify in edge in true length within either this projection of the plane or this projection of the plane.

Let me try to identify the edge in true length in this projection, I switch my pencil again to work with the 2H well do is that, you draw a horizontal line starting from A, it is always a nice idea, because they are taken be too many lines in our figures. It is always a nice idea to label the vertices and edges, before you start your drawing coming back, so this is my horizontal let me label it as D H, H is a subscript that represents horizontal plane, I take a vertical projection down. So, D H lies on B H, C H, so correspondingly D V over here, should be line on the edge B C, this point over here is D V.

Now, ((Refer Time: 04:32)) I would release my mille drafter ruler or the ruler or the mille drafter and I will align this ruler along the edge 80, and then I will tighten the screw here. I will join the two vertices A V and D V, V the subscript it means that all these vertices are represented in the vertical plane or the front view. Now, since A D is horizontal and it is parallel to this hinge in the other view A D will be in true length to remind myself, I will just write true length here.

And then what I will do is I will start taking projections from all the vertices and these projections will be parallel to A D. So, I will start from say P V, and then A V, why did I miss C V and all these projections are going to be construction line, so there will be as light as possible that is a reason, why I am using a 2 H pencil, there is a reason why I have fixed my drafter. So, that the longer ruler of my drafter is aligned to be parallel to these projections it is easier for me to, now locate the hinge line anywhere over here and this hinge line has to be perpendicular to these projections.

So, I will probably locate my hinge line over here somewhere and draw that again long dash followed by two small dashes. I will take my 30 60 s s square front here, and what I will do is I will measure distances of each of these vertices from this hinge line and I will transfer these distances over here respectively.

So, this perhaps is about 3.7, so I will mark this point here, may be I will just double check just to make sure I am not making any mistake, because if I make a mistake, then I will probably not be getting the plane in the edge view here. Perhaps 2.7 just about there I will just make a little mark here and then let me measure B from this hinge line this is possibly about 14 millimeters just close to 14 millimeters and that is B, I will mark B here. And, let me also measure C of the edge from this hinge line it is about 4.8 centimeters or 48 millimeters.

I will measure C V from here, 48 and mark it right here, I bring my 30 60 is a square and you could see that these three points are collinear. So, looks like the measurements are, so what I will do is I will join these points nicely and I will not forget to label them, now A V and D V should be lying on the same point here, because these distances are identical. In fact, I should not be labeling them, as A V and D V despite many reminders that I have given to myself that I should not be using an eraser I end up using one I should be focusing a singular more.

Let me also thicken or darken these projection lines just a little bit, so that my grader follows the construction that I have a formed, and let me denote these points as A1 and D1. So, this is my vertical plane, horizontal plane, my vertical plane, and plane number 1 and the triangle A B C is in the edge view her, this point is B1 and this point is C1. How about P and Q may be I should also mark those points here, I will measure P H from this hinge line it is close to about 76 millimeters from this hinge line.

I do not have to worry about cooling me out of T of P Q, because P Q happens to lie on two points P and Q. So, I will simply go ahead and mark this as P1 and how about Q I will measure Q from here, it is about 4 millimeters it is close to that and I forgot to shoot a projection from Q V here, which I will do right away. And, this was close to 4 millimeters, let me double check just about and this should be 4 millimeters from here, from this hinge line I will mark Q1 here, or may be let me first draw that line P Q.

Now, notice that the plane in the edge view and the line P Q they are intersecting at this point. That, is a first sign that will suggest that the plane and the line would intersect, but that is not the sufficient condition could be necessary condition, but possibly not the sufficient condition. So, we have to ensure that this intersection point also lies on the corresponding projections of the line in the frontal view and the top view and also this intersection point has to lie within the corresponding projections of these planes or rather within the corresponding projections of the plane there is a single plane that we are dealing with.

So, before I take this point or project this point backward onto the front view, let me join P and Q because that is where these points goanna lie, I am goanna be using a very thin light line. And then I will project this intersection point back, let me call this intersection point as I 1 in the first auxiliary plane, now this intersection point hits here somewhere, let me call this I V as in I V leak. And, if I take a vertical projection, now for that I would need to realign my drafter perhaps parallel to this hinge line, go back and check if it is really aligned possibly not.

So, maybe I will have to make a little adjustment see if the hinge line is looks like, now it is and then I project this intersection point up there. Now, this intersection point has to lie on P H, Q H I call this I H, now notice that not only this projection line is lying rather not only this projection this intersection point is lying on the line P Q the intersection point is also lying within the corresponding projections of the plane, implying that there is intersection between the plane and the line.

Now, could also possibly think of getting these intersection points using an edge view that I get with reference to the top view of this assembly of the plane and the line. Now, for that I would need to draw horizontal line here, in the front view [tangential] line call this E V take it is projection, now E V is laying on A B. So, take it is projection on A B

let me call this E H, now it is time for me to align the longer ruler of my drafter and let me join C H and E H, may be let me make it a little more dark.

So, this would be in true length E H,C H and I would just mentioned over here, the reason why it is goanna be in true length is because the corresponding projection E V,C V is parallel to this hinge line. Now, let me shoot projections from the five vertices in the top view, all parallel to E H, C H, let me be a little careful in drawing these projections making sure I do not miss any of the vertex. You know a slight chance of a mistake and things will go wrong, so one needs to focus one needs to be a little careful, but there is no harm as I said in making mistakes did, I miss I would done any projection possibly not.

Now, I am goanna be drawing a hinge line which is perpendicular to all these projections, so let me draw the hinge line over here. Make sure, I cover all projections, now this is my horizontal plane, so I will write H over here this is my second auxiliary plane, so I will write to. And then what I will do is I will measure distances from here, and transfer them over here, I will put my drafter aside for a while this distance is about 5.5, A B from this hinge line this would be 5.5 over here.

So, let me just make a little dot B V from this hinge line is about 13 millimeters just about. So, I would transfer that distance over here along the projection from where that is starts from B V or B H, in this case it is about 13 make a little dot, and then C V from here it is close to 42 just about close to 42 millimeters. So, I will measure and transfer that distance along the projection that is starts from C H it is about 42, so I will just mark it over here.

And I will try to make sure that these three a line, so I will draw a line joining these two points anyway perhaps. Let me check this distance again C V is it 41 or 42 it is possibly 41 millimeters just about, so perhaps it should be a little closer to the hinge line, now these three points they tend to align better using a 2 H I tried to join these three points. So, this is the edge view of this plane on the second auxiliary plane, let me label the corresponding vertices this would be B 2 always a nice idea to label C 2 comma E 2 and this of course, would be A 2.

How, about P and Q I did miss out this projection, now have it I will have to extend this hinge line of mine, which is not a problem there you go, let me measure P first from this hinge line this is close to well 73 millimeters. Let me extend this projection a little, and

let me also label this as P 2 and Q from this hinge line is about close to 7 possibly 7.5 millimeters. So, I will just transfer that distance here, perhaps here and let me write or let me label this point as Q 2.

Now, what I will do is I will join P and Q, but not draw and section would not draw this line yet I tried to figure, where P Q intersects with the edge view of A B C perhaps here. And, if I project this point back onto the line I am missing out on this intersection point, so looks like I have not done something right this seems to be, because A B C the plane happens to be in the edge view on this auxiliary plane. Let me go back and measure these distances once again did I say this was 73 millimeters possibly.

Let me use this scale instead may be this should have been here, looks like there is a problem with the two scales and 4 millimeters this is should be about 6.7 close to 7 millimeters. Let me measure that from here, just about right may be shoot that little to the left and once again, let this two point aligned properly, looks like I get the intersection point the same point or may be little above. Let me draw projection first it is would not be close there will be some errors, but it is and then I am ready to join these two points.

So, this is where my intersection point is let me call this I two I had already projected that intersection point over here, and so this is the same point I H the same point I V. So, looks like whichever plane you choose as a reference to draw the edge view, of A B C whether, this auxiliary plane or this auxiliary plane they should give you the same intersection point. So, the intersection point I did not find over here and over here, let me emphasize these points by encircling them here and here.

So, the edge view method is a little tedious requires a little bit of work it is quite effective and quite logic and not, so very difficult to understand. Now, the second aspect is which part of the line is goanna be visible in this area would be this part of the line that is visible or this part of the line that is visible likewise would be this part of the line that is visible in the front view or this part of the line that is visible. Now, that is very easy to answer if we have the edge views over here.

Now, if you look at this view a part of the line is in front of the plane or in other words this part of the line is closer to this hinge line. So, it is this part of the line that would be visible or that would in front of this plane here, now if I start from Q and come up to the

intersection point I one starting from Q coming up to the intersection point this has to be visible, so the plane A B C is lying behind this line. So, I will have to be drawing this part of the line as a solid line and of course, from the intersection point I 1 up till P 1 this part of the line is away from the hinge line, when compared with the edge view, of the plane, so this part has to be invisible.

So, I will be drawing that using dotted lines or dashed lines, I could something very similar in case of the top view, but for that I need to refer to the edge view here. And, that is one of the reasons why this edge view, helps looking at this part of the plane this part of the plane is lying closer to this hinge line compared to this part of the line. So, this part of the line will be hidden or will be behind the plane, so starting from Q up till I 2 Q up till I H this part would be hidden.

So, I will have to be drawing that part of the line using dashed lines and the rest of course, from here to here, this part of the line will be closer to the hinge line compared to the edge view of the plane. So, this part from I H to P H will be solid, so using the edge view method or the auxiliary plane method, we have been able to address both issues putting to the interaction between the line and the plane. Issue one to be able to get the intersection point and two to be able to find the visibility of the line, with respect to the plane which part of the line is in front and which part of the line is behind the plane in both of these views.

Now, took me a little while to draw the two edge views find the intersection point and then figure out the visibility of the line P Q here. I am goanna be demonstrating the same example using the cutting plane method to determine the intersection point and using the projection method to determine the visibility of the lines in both the views, these time me and check whether, this method is easier or more efficient to work with compared to the edge view method or the auxiliary view method. So, ready to time me I will first start with the hinge line that would separate the top view from the front view.

Now, this is something which would be tricky and there is something that I will try to make myself understand. Now, what I will do is I will imagine a plane that would contain this projection and that would be cutting this plane A B C, so my friend over here would be representing that imaginary vertical plane. So, remember this is the top view, so top view would be the horizontal view and this cutting plane will be the vertical

plane that would be cutting this top view and it will essentially be looking like that it is goanna go in and it is goanna remain vertical with respect to the sheet.

So, of course, this plane and the actual plane A B C they will intersect and they will have a common line of intersection. Now, that is the line that we want to determine, to do that and there is another thing that you would want to remember while you are working with the cutting plane method. So, remember that this vertical plane it will be containing the actual line P Q , so keep that in mind you can work it out.

So, let me start with this intersection point between that imaginary plane and this projection of the plane and let me project this point down. So, this point is lying on A H C H correspondingly when I project this point down it would lie here on A B C D, let me also do the same for this intersection point I will project this down and I will find that this point over here lies on B H C H correspondingly this point here.

Let me mark this point as say S H and T H two points here correspondingly S V and T V. Now, if I join these two points here this line S V T V is actually the line of intersection between the imaginary vertical plane here, and the plane A B C of course, S V T V is actually projection of that intersection line. Now, if I complete my P V Q V line here, carefully I probably have do this a little because if I would not made any mistake in this method I should be getting the same intersection point as what I got incase when I use the edge view method perhaps this intersection point is little off compared to this intersection point, but anyhow perhaps.

I did not take the points carefully or I properly may have made a mistake somewhere over here, not to bother should the intersection point should have been over here somewhere. Let me give this another shot why not I should be getting the same intersection point should not I seem probably it is my drafter that was not proper because if I look at this vertical and if I look at this vertical you see this projection over here, is not coming properly.

So, let me align my drafter properly and work this thing out again I deserve to be getting the same intersection point do not. I well before I proceed, let me finalize these edges of the triangle it is very important for you to have your instruments calibrated properly and as [acquired] as possible, when you are drawing these concepts on a sheet of paper. So, now this vertical over here seems this vertical seems possibly not aligned properly may

be I will just readjust that is not a part of the time that I am supposed to be investing on the cutting plane method.

I could also see some discrepancy in the position of P V seems little better, but this intersection line goes well little adjustment here, and there thing should be, now once again projecting these S H point down and this should be lying on A C. So, I should projecting this thing further down there that is my S V little change not very much from here to here, possibly that could make a difference and T V how about that T V moves slightly to the, let me erase this part here somewhere.

Now, let me complete this line P Q first start worrying about the line S V T V and if I do everything. And, this is the point of intersection that I get again it is not very close to I V that I expected, but this time I guess I will give up something must not be right, but again is not the of course, intent is to be as acquired possible, but it is more to demonstrate a method. So, this is the point of intersection I will encircle that and this point has to be lying on p q in the top view I will have to project this up and so let me label this as I sub V and label this as I sub H and encircle this point.

So, I expected the positions of these two and the positions of these two to be identical in both views, but somewhere I may have made a mistake I will probably have to redraw this again, but not today. Now, as first intersection is concerned the cutting plane method that the imaginary plane that passes through this line P H Q H that intersects. The plane A B C and the projection of that corresponding intersection line is S V T V that would intersect with the projection of the line that we have P Q this would give us the intersection point I V in the front view if we take it up that is the projection point I H in the top view.

Now, coming back to visibility now for that we will be using the projection now look at this intersection point again S H. So, that is the intersection point between P H Q H and a H C H, now this point represents the point on P Q as well as point on the edge A C in the top view. So, in the top view this point would be the same, but in the front view if I bring this point down the corresponding point belonging to A C will be here, but the corresponding point belonging to P Q will be slightly above.

So, it is. So, if I bring this projection down is P Q that I am hitting first in the front view compared to A C. So, that corresponding part of P Q will be visible, so this suggests that

P Q is lying above the plane in the top view and therefore, this part will be solid, let me switch pencils. Now, if you compare this part of the line P Q with the corresponding part that we obtained using the edge view, method this seem to be consistent going back to the projection method.

Now, this point here is the same point on the edge B C of the plane and the line P Q in the top view, but if you take the projection down from here. The corresponding point on edge B C is above the same point well the image of that point on line P Q which would be somewhere over here, so this was suggest that P Q is behind the plane and that would be in the top view. So, that is the reason why this part will be hidden and therefore, shown using dashed line I can do the same exercise starting from the front view I take this intersection point take it up my drafter must not be very accurate over here.

Because I end up losing the parallelity between the lines or parallelism between the lines whichever is the correct English or use of English. So, anyhow, so I take this projection up from here, now this point in the front view represents the point on the edge A C and the corresponding point on line P Q up there edge A C would be appearing before P Q. So, that would mean that this part of P Q will be hidden behind the plane and that is the reason why they should be shown using dashed lines.

Now, if you look at the corresponding segment of the line this is also shown using dashed. So, apparently the projection method of visibility or of determining visibility happens to be consistent with the edge view method of determining the same, so now this is hidden and if I take this intersection point up there. Now, this point is shared by P Q and the corresponding point on P C, but if I take it up P Q would be getting hit by this projection line before, B C does that would mean that P Q would be visible in the front view again consistent with this segment of P Q.

So, remark this is a wonderful logical method and so is this gives you details with regard to the edge view, of the plane and the line the intersection projections back and also it helps you to determine the visibility of line P Q. This method the cutting plane method and the projection method in combination to determine the visibility seems a little faster if it is understood properly you know what I was not very happy with the construction over here, possibly because my drafter had some errors in this part of the regions what I did was I came over here. I had some space I redraw everything over here using the

cutting plane method and it looks like the intersection points that I found or quite close to the intersection points that I have using the edge view method.

Now, ideally if there are no mistakes and if my or accurate I should be getting these points to be identical to these corresponding points and thus the ideal case and of course, visibility remains the same. So, this part is hidden behind the plane this part of the line is hidden behind the plane whereas, this part is visible and above the plane and this part is visible and above the plane.