Technical Arts 101
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Lecture - 40
Lab 12

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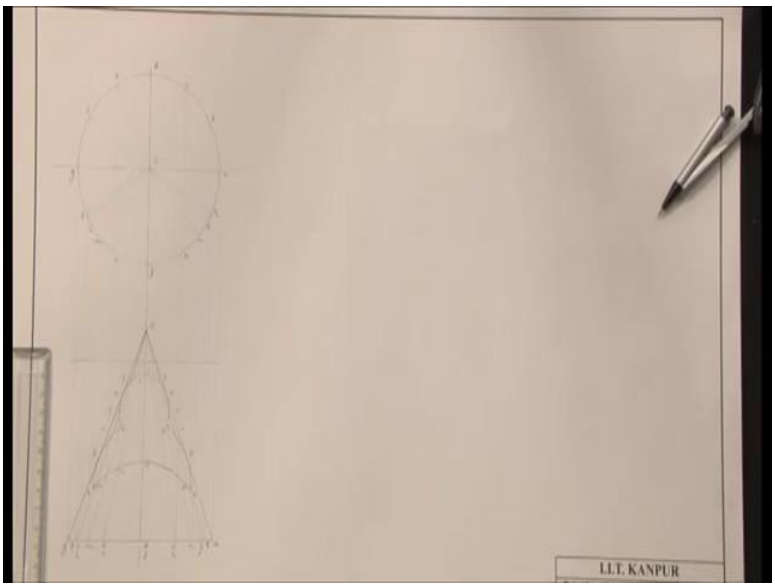

This is the final example on development. So, shown here are two figures this is the front view of a cone and this cone over here, is the intersection between the cone and a rectangular prism. So, I have drawn this curve I have kind of transferred this curve from an example, this curve is slightly similar to the previous example. But, in the previous example we had taken a diamond prism as appose to a rectangular prism, this curve corresponds to that from rectangular prism and of course, I have also taken the top view, I have not transferred these intersection points over there.

For a reason, but this is example is on development, so you should realize very well that a conical surface is developable, and it so turns out that if you cut, this conical surface and kind of flap it open it would lie nicely on a piece of paper. Allied nicely on a plane, which is what we are trying to do in this example, and we would also try to capture this intersection curve, this curve have intersection on that developed conical surface.

Now, think about sheet metal work this is precisely what they do, so what they do is they would actually develop the conical surface. They would transfer this intersectional loop

on that, then they would kind of mold that surface into a cone, and when they do that they would get the intersection curve just like that. And, you know you can actually place the rectangular prism over that or inside that or within that you know little void that slept; so we will try to do that, primarily you know prepare for sheet metal work.

So, enough of talking let us get down to business, so to develop a conical surface of course, this would be you know if you kind of cut this cone and if you flip it open, flap it open on the plane. You know, this is conical surface goanna open out as a sector and the radius of that sector is going to be this much, you know the slant length of a cone.

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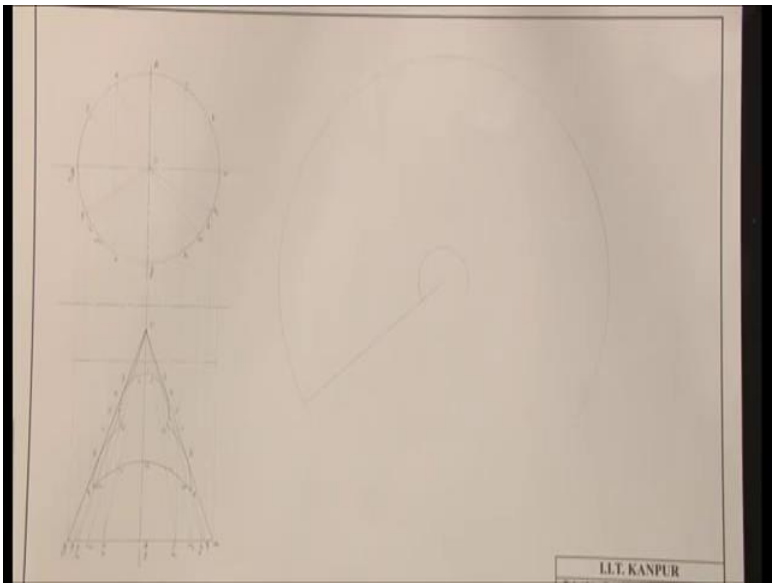

So, what I will do is I will first try to capture that, I have that pretty much, I will probably take any convenience center, and perhaps somewhere over here. And then draw a little sector may be I will start from here and you know just draw a little sector here pretty much like that. Now, what I also have is I say that alright, let this apex of the cone be you know cut by a horizontal plane, so that we see a little void here. So, let me also draw that corresponding arc, it is probably going to be this radius and let me draw this right here, just path here, and let me make a line to start with.

So, I am not going to be labeling as if now, but perhaps later I will do that, so this my start line for example. Now, one of the problems that I need to address is, I need to you know capture this void as a single loop within that developed surface. Now, if you look at, for example, i j segment i j here, and segment i j there, and if you go back to your

theory you would observe that this segment is parallel to a hinged lines. So, I do not have a hinged line here, so maybe I will just show that, this is going to be parallel to this well perhaps I should be using my drafter switch to my 2 h pencil just kind of you know draw a little horizontal line here, perhaps little darker and then use my such square front.

So, this is my hinged line, but the point I was trying to make was that this segment is parallel to the hinged line and therefore, this straight line is going to be in true length. So, if I assume this arc to be of you know approximately the same length as this line segment j k or i j for that matter or any other line segment for that matter because for all these line segments the corresponding projections they are all parallel to the hinged line. So, perhaps what I would do is I would take this as or this two approximately represent the length of this arc, and this length how start cutting down this larger arc.

So, if I start from j for example, then 1, 2, 3, 4, 5, 6, 7, 8, 9, well 10, 11, 12, so perhaps 12 of these arcs or perhaps one more. Let me, you know just go and keep cutting and maybe I will come to later, so 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 perhaps one more 14. So, of course, when you open up this conical surface it would not be reaching to a 180 degree thing, but it will be little smaller than that and assuming that this is my starting surface. Now, if I go back to my example and perhaps give you a little peek.

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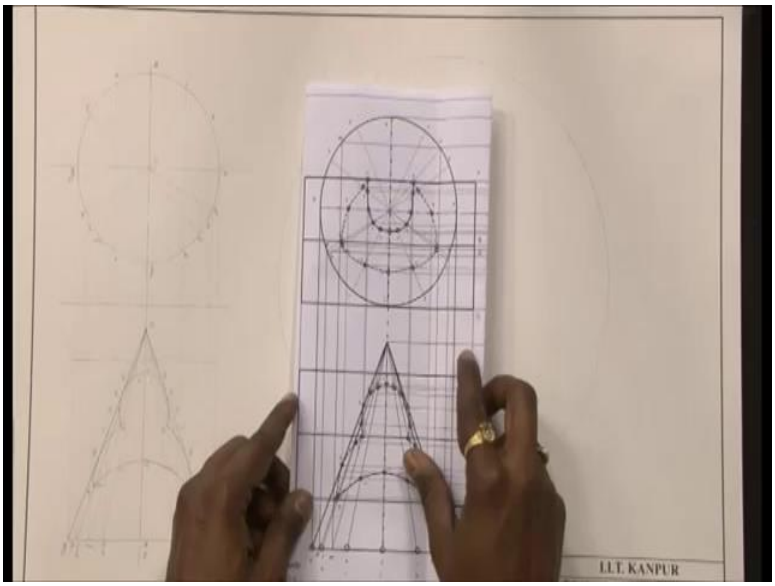

On the top view of this here, you would see that sectors c o d and d o e they do not contain any part of the intersection. So, c o d d o e so there is no intersection or there is

no part of intersection curve in there. So, perhaps what I will do is I will start you know nomenclating or naming these points from say c, the curve would allow me to have my intersection curve somewhere over here, and then I will go cyclically.

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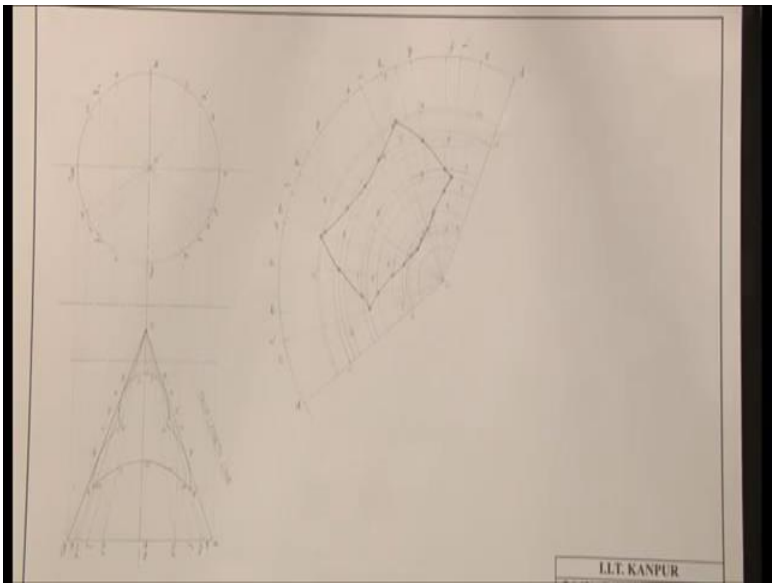

So, let me start with c and then d e f g h i j k l over here back to a b c d well I do not think I would need d. So, perhaps I will stop down till here, c to c and I would erase the rest of this bigger arc as well as smaller arc. I will try to make sure that I do not leave any phrase of the bigger arc as well as the smaller arc having done that and of course, this is my apex point o or apex point, how so ever its pronounced and from this point I will start joining you know the points on the arc. I should be using my two H pencil for that because these are construction lines, I will emit well.

Slowly, but steadily I am not sure if you are realizing that my stable, my table is unstable or slightly unstable times pretty well my stable my table is unstable or my table is not so stable, so it is a bit shaky, but I do not think I should be complaining. Now to take of I have to take care of some special leaders or generators o q o p o m and o n. So, may be let me draw o n because my intersection points also lie on these generators of these lines.

Let me, try to locate them, so p is in between g and h and of course, g p I can assume it to be in true length because g p over here is horizontal. And, I would assume that p and q they are lying on the same horizontal they should be lying on the same horizontal, so I measure this arc and from g towards h it is going to be very close to h from g towards h.

I make a cut and call this p and likewise from a towards l, a towards l I make another cut in same radius and call this q p and q with the center.

And, let me take care of m and n, so from I can measure this arc length, from k I can measure this arc length. This should once again be the same, m and n this should be lying on the same horizontal, I can just verify this quickly looks like they do and then I measure the arc length from q this arc length. So, it is going from well maybe I should be measuring it from l it is even better.

So, from l towards k, from l which is here towards k, and this is my point n let me name it and on the left side from h towards m, let me make sure that I have this length right just about from h towards i, from h towards i my point m should be here. Let me, name this point as m, and then join o to m and o to n, first n and then m.

Now, having all the generators on the developed conical surface well have a scar on my sheet how much of you notice it probably you do not nevertheless. So, having these generators on my developed surface it is time for me to transfer these intersection points on the respective lines.

Now, notice that all these intersection points are lying on the respective generators in the front view. Now, if I want to get the true length if you notice this would be the true length, this would be the projection of that length projection of that length projection of this length projection of this length and so on and so forth.

So, to get the true lengths of these intersection points from o, I would need to project all of these intersection points on to this line. So, let me call this line as a TRUE LENGTH LINE should have come out write and I will erase the rest of this which I write the recital from sheet. Well, I was wrong when I said that I will not be using the drafter this is the critical part make sure that I have the longer ruler align with the horizontal, the critical part is to transfer all these intersection points on to the true length.

So, point number 1 point number 2 point number 3 4 already lies on the slant length of the cone, point number 5 6 7 8 also lies in the cone, 9 10 11 and 12. Now very carefully, I am going to be measuring these lengths from o and then transferring them back on to the respective generators or selective lines, I am going to be using my compass for that.

First is o 1 right there o 1 lies on a, so this is where my intersection point 1 is let me label it just double checking if I have everything all set because I do not want any part of my intersection loop to be lying away over here. Even, if it does it is really matter I can always you know extend this part of the cone then erase the other part seems, I mean well nevertheless.

You know what is c o b going to be having a part of the intersection curve, back to my top view c o b looks like it will be having quite a bit of this loop. Perhaps, it is nice idea for me to extend this well take care that later. So, point 1 lies on o a, point 2 it lies on c and k, so c there and k would be here, so this is intersection point number 2.

So, point number 3 extend this further, now point 3 lies on it looks like point 3 lies on q great lose to be here. So, this is what point 3 would lie l and q are quiet close to each other, and b and l well let us see b l q. Let me, mark an arc over here, so this is where my point 3 would be would be on p as well if I take a look at this 3 should be lying on l and h, if I am looking at the top view.

So, l and h, so l is here, h would be here, I am not sure if I am doing this right, but well we will come back to that later. So, let me not label 3 for now 4 definitely lies on a and g. So, this is a and q, let me label this that is what I am sure of point 5 lies on b and f, number five lies on b and f b is here, f is here.

So, that is intersection point number 5 6 lies on the special leaders,. n and m let be the length here that lies on m which is there and n which is here. Number 6 number 7 where does that lie point number 7 is here looks like it lies on p and f again p and f. So, let me measure 7 the true length of that here, and it lies on p and f. So, f is here, and p is there, and we call it 7.

Number 8 again lies on a and g, a and g remember I still have to come back for the intersection point number 3 because I was not sure where it would lie should not be very difficult for me to figure it out nevertheless number 9 if you look at the previous example or even if you do not want to that is fine, but 9 lies on q special leader and p. So, I have my q here. So, 9 would lie here somewhere and here somewhere, so that is on q and p, so this is number 9. Let me indent this point little bit, so that I do not confuse between these two leaders.

Number 10 that lies on p and f again little short on length, this is 10 10 there is a possibility that I may have to extend my developed surface on this side there is a possibility. But I am not really sure at this time 11 it lies in c and k, now, c is just about there, 11 true length it is right there lies on c and k the two c's and k. Let me, name this as 11 11 and 11 here, and number 12 of course, is on d and j, so j is here, t is here that would be smaller in size of course, on j and d this is 12 and this is 12.

Now, if I have my intersection points here, it is not going to be possible for me to get the entire loop within this region. So, I will probably have to do something either I need to grow my sectors along this direction or a simpler thing that I can do would be to erase this and renumber this. So, that I get this entire loop within here somewhere.

Perhaps, that would better I have already transferred these distances, so that should not be a problem. So, I will just go ahead and erase this and then rename this, one make sure that I erase these nicely it is quite possible that I need to locate my special leaders again that should not be a problem. Now, before I rename these vertices, let me take a look at the top view of this figure, and notice that it is this sector c o d and d o e that is not contained any part of the intersection curve.

So, is it safe for me to start with d or perhaps is it safe for me to start with e if I start with d and go it will does not matter. So, if I start with d let us say from here, and then go anticlockwise I probably would be missing I probably would be find over here, and then I will probably expect my loop to be on the left hand side as I traverse anticlockwise may be its better if I start from d here, and then of course, over here I will be back to d.

So, if I start with d from here, then this would be e this is f, this is g, this is h, i j this point over here would be k l there and then a this is b this is c and this part is d no problem there. Well, let me adjust this radius and draw the sector nicely this is part that got erased and you know I will do a little thing which I think it is smart, but later on it will be confusing.

So, what I will do is I will make you know all these marks over here, so this is for the intersection point 1 point 2 well I have not yet marked 3, but I will start with 4 and then move to 5 this is not very difficult at this time, but when I am going to be marking the final intersection points, there are chances that I might make mistakes.

Number 6 7 remember that I do not need to do this I am just doing this to make my life a little more complicated. Number 8 9 10 will be slightly smaller, 11 still smaller well quiet to be little careful there I am and finally 12 too many arcs, nevertheless first thing is first let me try to locate m and n again.

So, if I measure from i just about there, so from i towards p or from i towards h, from i towards h this is where I am going to be getting m. Let me name this point, and then from k towards l same radius k towards l here, this is n. Let me join m and n to o, let me darken this little bit even though I know that I do not need this anymore.

And then how about p and q, so from a to q that is the longer length easier for me to measure a to q towards l, a to q towards l. So, that is my q and from g to h from g to h that should be my p drawing my new q to 0 or o should be using a different pencil and my new p to o looks like I am ready to mark my intersection points.

Point number 1, now for that let me use the top view easier for me to work with that point number 1 lies on j where is my j k . So, this is the arc for one this is the point that I guess I will be getting. Number 2 lies on i and k. So, i is here k is here, perhaps so that is number 2 that I get.

Number 3 is on l and h perhaps, on l is there well I do not have the radius for that or maybe I do not sure that is number 3 that is the radius that I have alright, so 3 would lie on h and l that is my l. So, it is probably going to be lying here. Let me name this arc as 3 over here and h it is goanna be lying here, and from here. on I guess I will be so 4 lies on a and g 4 is this arc lies on a and lies on g.

There 5 lies on perhaps p and l I probably have to pull it up back 5 lies on p and f on p and f does not lie on l. So, 5 lies over here, and over here number 6 lies on m and n that is interesting m should be between h and i, from h towards i from h towards i, m should be from let us say k towards l from k towards l. So, looks like m and n are but should the intersection points be here well lets not worry about 6 for the for the moment 7 lies on b and f again 7 lies on b that is for 7 and f there I am 8 on a and g this difficult for 8 that lies on a right there and g should be here looks like I am getting a loop.

But I am still to decide on 6, 9 lies on special leaders p and q, so this is the arc for 9 is to be lying here on q and on p. 10 lies on p and f once again put this up lies on well lies on l

and h would have been nice idea for me to you know have this intersection over here as well, but let me take this as reference.

So, b lies on h and l 10 section point number 10, so this is l and this would be h here right. So far so good 11 lies on i and k this is the arc for 11that is k and that is i and 12 has to lie on j. So, the arc for 12 lies on j once again tracing from j going all the way coming back going all the way and you know coming back.

So, 8 point number 8 is somewhere over here 8 is on a and g. So, should be and here what I will do is I will take a little break for 5 minutes and then come back and try to locate the point that I have not been able to locate. So far, so point number 6 looks like I may have missed something see in a while.

So, while I was taking a break, I was trying to figure where did I make a mistake because I was not able to get the sixth intersection point, and if I look at the top view that I have and if I look at the top view is there I immediately realize what my mistake was what my folly was and the folly was that if you look at my special leader point m here should be up there not here.

Likewise n should be up there and not here, so if you follow the previous example you would be able to realize it better that was where my mistake was and of course, these generators are therefore, not correct. So, that is what I would do I would make that correction right now. So, my n is here in between b and c and my m is here in between e and f having said that well let me call this n prime i do not erase anything further let me call this m prime.

So, let me join m prime with o with the 2 h and n prime with o with the 2 h. So, m prime is now lying between e and f, if I start from e its more towards f let me capture this arc. Of course, if I look at this corresponding projections horizontal and its parallel to the hinged line likewise this is horizontal and parallel to the hinged line therefore, this would be true length you know about that from the theory.

So, center as e and towards f I am going to be drawing this arc, let me call this m prime and to locate n prime center from center as b where is my point b and towards c, so center as b and towards c this is my n prime. So, having located these two new leaders I am going to join them using the 2 h I am going to join m prime to o which is did and

now n prime to o and then becomes easier for me to locate the intersection point 6 which I was unable to locate last time.

So, the arc for the intersection points 6 is here and this is where is going to be lying on m prime and on n prime it is going to be lying here. Now, that is the arc for 7, so this would be the arc for 6. So, I have to be very careful specially when I am not labeling these points. So, this is intersection point number 6 and here this would be the intersection points 6 right there.

Now, that I have made so many mistakes in this lab, it is perfectly one should rather invite mistakes that is how we learn what I would do is I would kind of circle these intersection points just to give you an idea is to have the look. So, number 1 is here may be I will just use the smaller circle.

Number 2 is here and so it is here number three is perhaps here number 3 is on l and p, p l and possibly f as it or anyhow. So, number 3 is h that is h, so that is number 3 got to be extra careful because if I did it wrong then I will have to erase the entire thing perhaps I need I would then need to do this lab all over again

Number 4 is on a and g does on a and g, so here and g, g be here somewhere 5 is on special leaders p and q special I do not know why keep saying them special why keep calling them leaders, their generators 5 is on p and q is it or its on p and l looks like it is on p and l getting my top view back p and f rather p and f. So, this is my fifth intersection point p and f should be here somewhere.

Perhaps my sixth intersection point is on n prime and m prime this my sixth, hope I am getting it right and here m prime alright my seventh is on b and f is it seventh on b and f looks like it is my seventh that is my seventh there. Eighth is on a and g, so my eighth intersection point is on a and g there and there.

Let me mark them, and this one right there my ninth is on special p and q, so I got my ninth here on q, and this is p ninth from p, tenth is on b and f possibly or perhaps it is on h and l well let me get back to the top view tenth would be on l and h. So, my tenth on l and on h too more eleventh is on c k and e I looks like I have got k and I here.

Now, which one is my eleventh and which one is my twelfth, so looks like this is my eleventh alright. So, these, these, these points are, but maybe I dint mark number twelve correctly. So, these points are eleventh is on k and i and my twelfth is going to be on j and has to be here to verify let me take the true length for twelfth it is my twelfth my true length going back over there well here is pretty much going back over there and this is my arc for the twelfth. So, this should be my intersection point here on j. So, I will just mark it there.

So, having done that now I am going to be very careful in sketching that two part I will have to get up go to the other side of the sheet and using free hand sketch it nicely. So, I will start with j this is point number 1 well let me see how it goes somewhat like that perhaps and this loop over here would be 0 and then this is point number 5 I believe all this point number 6.

So, 1 2 3, 4 5 6 and then 7 to 8 to 9 and then this would be my tenth eleventh and twelfth. So, this how the intersection loop is going to be, now let me darken this using the h pencil and this time I am going be quiet careful doing this free hand ideally I should have used French curves. Once again here the slope is going to be 0, so this is how this loop would probably look like bottom line there are chances of lot of mistakes that one can make one needs to be a little careful, even if one is careful even then there are chances that you might still make a lot of mistakes do not worry about that keep making mistakes keep verifying them keep learning from them. But try to ensure that once you learn from them you do not make more mistakes from then on.