Lab -11

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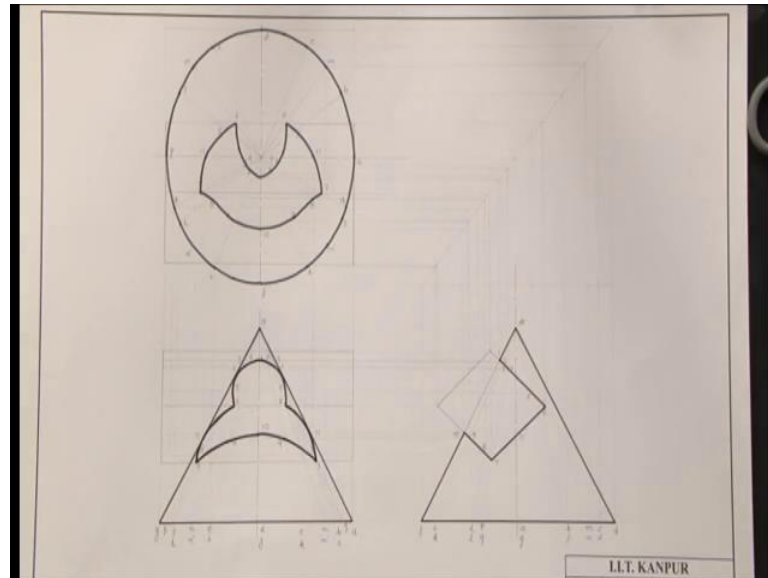
This is example number 10. So, here we try to figure out the intersection between a cone and a prism was cross section is a diamond. So, this is the profile view this is the third angle set up profile view the front view and the top view. So I have deliberately marked the surfaces as dark lines. Ideally I should not have done that. But nevertheless I have done that, so that I can distinguish between the projector lines. And the surfaces clearly as I draw or as I try to or attempt to figure out the intersection between a cone and this prism.

Let us look at this front view here. Is it possible for us to figure out directly where the intersection points are going to lie by inspection, possibly not. In the top view also by inspection possibly it is not easy for us to figure where the intersection points are going to lie. But if you look at the profile view, the intersection points they have to lay on these 2 surfaces of the prism rather these 3 surfaces of the prism. So, once we realize that maybe we can take this profile view as a base and then whatever section points we are going to get from here. We are going to be transferring those points on to the front view and on to

the top view. Let us get started at this time it is important for us to you know make some basic construction and label. But before that let me summarize that they are 2 methods to try to find the intersection points between 2 solids or interpenetration points or interpenetration curves between 2 solids.

One is the select line method and the other one is the cutting plane method. Now over here it is obvious that the intersection points are going to be lying on these 3 edges. So, perhaps it is easier for us to represent the cone using a set of lines and then try to find the intersection between those lines and these edges of the prism. So, let us get started. Let me start working with the top view here and try to divide this circumference of this base of the cone into equal number of parts. So, perhaps I will be dividing this into 12 parts each or rather 12 sectors with an intermediate angle as 30 degrees. Let me ensure that my drafter is a line probably and then my first 30 degree line is going to be of course, passing through the center. I am going to be taking or I am going to be using a 2 H pencil for that. And my second line is going to be again passing through the center at 60 degrees.

So, I am using the 30 60 90 set square and try to appreciate how I am positioning my set square in such a way that I get my 30 degree angle first and then now 60 degree angle. So, I got 1 2 3 4 divisions. Likewise; on this portion of the circle and, if I want to get a 60 degree here, perhaps it is a nice idea for me to flip this over or may be my drafter is getting logged over there. So, I will try to figure a better way to do that. Yeah of course, a better way do that is you know just take horizontal projection from this edge, get this point there. Take horizontal projection from this point. Get this point here and then join these using a straight line that of course, has to pass through the center. Now at this time it is a nice idea for us to label these twelve points on the circumference of the base of the cone. So, let me label them as a b c d e f g h i j k and l. Let me darken these construction lines a little so that they are you know clearly visible to you looks like they are now.

Now, let me transfer these points 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 on to the space of the cone here and the space of the cone here. Now for that, perhaps it is a nice idea for me to work with the longer side of the ruler. Align that with the center line just to make sure that this kind of vertical and start drawing the verticals from here. Let me draw all the verticals and then label the corresponding points on the space. And let me realign my drafter. So, point a is going to be here. Point b and l, point's b and l both are going to be here. c and k, g and j, e and i, f and h and finally point g here. This labeling is important

because we do not do that then there allow chances that we will get last midway, while we are constructing or while we are trying to locate the points in section.

Perhaps, it is a nice idea for me now to project these points horizontally on to this 45 degree line. So, maybe I will start doing that from here from c and with an axis b. We have got a there and then l. Possibly I over shot by a little amount and then k here. And then let us get these points on to this space of the cone. Dim lines you know perhaps, nice idea for me to realign my drafter so that the longer ruler becomes a vertical. Now, make sure that I have got the vertical probably here. Then, from there we go down here up to the base of the cone. From here again up to the base of the cone and finally, from here. Maybe let me go to this center line or these horizontal lines then from there extend this vertical. Double line there but not a problem and let me realign my drafters that my longer ruler becomes the horizontal.

Now while labeling these points will have to be a little careful. So, d is coming here, c and e go down here, f and b here, a and g along the axis. And then l and h, i and k down here, finally j here once done. And let me call this apex of the cone as point 0. So, once done the next step for us is to represent the surface of this cone by using, what we call as the select lines or generators. For that, let me not worry about aligning my drafter again. Let me rather use my set square and very carefully join these points on the base of the cone with the apex or the vertex of the cone. So, these are called generators or select lines, got to be very careful and in the front view as well; there I am. So, if you now look at the profile view, the intersection between this prism with the diamond as cross section and the cone will primarily be those between these generators and the 3 edges. Have you notice this vertex and this vertex; these are going to be special vertices treated specially.

Now, if you notice we do not have a generator passing through this vertex and likewise passing through this vertex. So, perhaps to get the intersection points corresponding to this vertex and this vertex we would need additional generators. And let me draw them as well in the profile view right there and let me name them as say m and n. Likewise, let me draw another generator from here and let me name these two points as p and q. Now, you would ask me why two points m and n here and p and q here. Well, if you project this point upwards and further upwards and then make sure that horizontal is properly aligned. Make horizontal projection just about, there may be a little more up perhaps here and you know using a set square aligning this edge, aligning with this edge then in point here.

So, m and n would correspond to one of these points each. So, let me name this point as m and this as n. All have to do is project these points down up to this and further down to the base and let me call this m. Likewise, I project this down up to some horizontal line over there and then further down. Let me call this point as n. Now, also notice that you know there is a point of intersection between this vertical projector and the circumference of the base of the cone. Let me call this m prime, so that we have m prime here. Likewise, we will have n prime here and m prime here. How about p q? Well, the same treatment, project this on to the circumference of the base of the cone right there. So, I got p here and I have got q here. Project these points downward. Make sure I have my vertical line probably and likewise from here q.

Let me have p here and q here. So, too many points that we have to deal with. Now starting from the profile view, we start figuring out the points of intersection in the cone as well as this prism. Of course, this is my first point of intersection. Let me name it as 1 this is the second one 2, third one 3, fourth one 4, fifth one right there 5, sixth one between the vertex of the pyramid or pyramidal well vertex of the prism and this special leader here 6, and then 7 again between the vertex of this prism and the special leader, then 8 9 and this one as ten. So, working with prisms it's relatively easy but if you are actually trying to figure out the intersection between a cone and a cone then things become a little difficult. I will try to take up this example later but for now, let us focus on the intersection between this prism and the cone. So, once we have the intersection points let us try to transfer them on to the front view and then on to the top view.

The transfer has to be very very careful. We will have to keep configuring your drafter if it is you know disturbed frequently. So, I have this horizontal well may be there and then from point 2 got to be quiet be careful then point 3, point 4, these lines are going to be parallel of course, but they are going to be quiet close to each other. And quivering the intersection points over here will be a little tedious. That is a reason while labeling becomes quiet important; point 5 there. Well I start working with point 7 onwards. So, points 7 is going to be here, point 8 it is my drafter align properly well yeah; no, little adjustment just to make sure that my horizontal is alright yeah and then point 8 perhaps there and then 9 finally, well not yet done still have to figure out the projection from the intersection point 6.

Well, let me draw well the intersection point 6 has to be lying on this line any ways. So, I already have a part of it, alright. So, there we go now if you notice point1 is going to be on leader or generator j. So, this horizontal intersecting with j, j would be here so this point 1. So, let me make this as point 1 here. Intersection point 2 will be on 2 generators i and k. So, k is this one i is this one. So, it will be here and here. Let me name them as 2. Point 3 will be on h and l. So, going back this is generator l and generator h. So, once again going to point 3 and this would be my third intersection point at l and at h. So, let me name them as 3 little outside the cone. Intersection point 4, this is on special generator p and q. So, I need to draw those generators in the front view as well. Point 4 on q and p yet so happens that point 4 and point 7 they both happen to lie on q and p. Well, point 4 may not be that important but anyways since, we have it let me mark it anyways on p and q. So, point 4 would be here and here on p and q.

So, let me name this number 5, this will be on p and f. So, b is the third one got to be quiet careful and f is again third from the left, so this is intersection point 5. Point 6, this will be on special leader m and n, this could be lying on this line where would intersects m, m would be; so I need to draw another set of select lines or generators in the front view to get point 6. So, once here and the other one is right. So, back to point 6 this would be on m and n, yeah. So let me name them as number 6 number 7 this would be on p and q again. So, 7 so this would be on the base line of the prism and p and q so p is here q is there so we have point 7, number 8; this would be on h and l, l is here and h is here number 8 got that.

Labeling is of utmost importance otherwise we will lose the track of the sequence of these intersection points. Number 9 this will be on i and k. So, k is there, i is there. So, this is intersection point number 9 and finally, 10 will be on j. So, this is j it is 10. So, great so we have a sequence of intersection points and looks like it is going to be; so they they are kind of arranged symmetrically from the vertical. And its quiet obvious, because you know intersections going to happen on this side of this of of the cone and the other side of the cone. So, that is that is one of the reasons why we have symmetric placement of these intersection points. Now, always nice ideas to use you know different mechanical gadgets so that we can get a smooth curve that would join these points. Let me give here is short so French curves four at a time. Let me try to force work on the symmetric right part and

perhaps use my H pencil to finalize this curve and may be flipped over work on the left symmetric part.

Well, the slope here is going to be horizontal so it is a continuous curve. And then try to join these guys, flip it so and perhaps try to join if it is better. This is the difficult part confiding. I got this part right seems and if I flip it should be getting. Well, let me try the inner side it is probably not going to be looking symmetric but perhaps I should have used that part as well over here perhaps. Well, let me erase this and see if I can do any better. You know if you are not careful, things will probably not work out to your satisfaction. Again these leaders or generator is back, well they are not leaders they are generators more. So, I already had this point. Let me mark this is 5 and 6 back.

So, I had these two points already and perhaps let me think of joining 4 5 and 6 through. Well, may be this this would be a better perhaps should not be symmetric me. Let me let me try it free hands how are that. So, I will use the construction pencil and then from 6 to 7 and then may be let me let me join for 7 8 9 and 10 perhaps using the French curve. Would that that would be easier seems looks like looks like that would be easier and in gentle curve. It is frustrating or maybe I have it.

Now I just about have it may be I will little shift down yeah just about there anyhow ok. From 6 to7 do you think we should probably have you know another point in between them? So, that getting a curve becomes easier so how about this point perhaps, so may be let me let me call it 11 point number 11 and this would be the intersection between this vertical generator a g and this point here. So, let me call this 11, take horizontal projection from here there we go and 11 would be lying on a and g. So, well goes to here and here dot in surface so it becomes a little easier for me to complete this part.

So, this is 11 and this is again 11. Back to the use of French curves, I should not be using it rather I should be relying on my skills to draw free hand, but looks like looks like I have the c points lined up or curved up very nicely using French curves. So, notice that no no part of the curve which should be lined outside the surface of the cone and perhaps, like likewise I could do the same thing here, just about there yeah better; yeah so it is going to look some like that ok. Perhaps, I can talk on this intersection curve offline and you will you will come to know about that, so that things become lot more you know clearer. But before I do that perhaps it is a nice idea for me to take the projections of all

these points up over there or I could as well get the projections from the profile view on to the top view and to get all these points over there. Let me go offline for a while and try to you know darken this intersection curve ok.

So, I took a little break went offline and then using free hand I kind of drew this thick curve. And then I realized one thing you know if there is prism was to be there then this part would have been hidden and correspondingly these curves they should have been shown using dashed lines. Well this part was going to be visible in the front view and therefore, this curve should have remained solid. This remains solid alright, but I had also kind of represented these 3 curves using fit lines. Now what will that mean? That would mean that this curve is a result of this prism having cut the cone and the prism now is taken away. So, this is essentially solid cone minus solid prism that you would be seeing this curve all in solid in the front view. So, I will have to keep that in mind and you know.

To remind myself that this is actually the cut solid solid cone, I mean the prism cut from the cone to remind myself of that what I will do is; I will kind of thicken the cone surface as well. So, look pretty neat. I am going to do that later I am going to thicken the lines later over here. I am not doing that here because I need to transfer these intersection points back on to the top view but let me finish this line first. There I am looks pretty much in contrast. So, I will come back and darken the relevant features essentially this feature here assuming that the prism is no longer there. But before I need to transfer the intersection points back on to the top view, and for that let me realign my drafter so that I have the longer ruler as my vertical. Having done that let me quickly transfer these intersection points on to the 45 degree line; haste makes waste.

One very good friend of mine roger savant of Aurveda Harkin University, came up with the dash phrase, I will try to remember that after. So, I am going to slow down here and very patiently transfer all the intersection points, so five of them already done. Sixth seventh is already there, sorry eleventh is already there and so seventh perhaps eighth now and then ninth and then finally, my tenth intersection point. Back to the horizontal, my first intersection point is on j. So, it goes up from there I mark my intersection point right there on j, and I also label that. Let me darken this projector line; let me darken this horizontal projector better; so this is point number 1. Well, right there number 2 goes until there 2 lies on i and k, generator i is there k is there.

So, intersection points 2 indent that little bit, 3 goes from here; 3 lies on h and l just want to make sure that, yeah so intersection point number 3. Always a good idea to label, number 4 lies on p q. So, I need to have the corresponding generators joining the center of the cone and q and p and the center of the cone. Looks like my horizontal is alright this is going to be a little interesting. So, these are points on q and p intersection point number 4 number 4, number 5 is lying on b and f b and f; point number 5 here. Number 6 is lying on special leader m and n. Now, for that I need two generators joining the center and m and center and n of course point number 6 going to lie here. Moving up there well looks like this is not that parallel. Is it? Anyhow, so let me take care of 6 first and then get back to intersection point number 5.

So, 6 is on m and same is on n. I need to be very careful, my drafter is getting logged over there and that is a reason why I am not getting a line which is parallel which is what I expect. From here looks like I should have gotten points much lower than what I got over there. So, perhaps what I could do is I could erase this part erase this part meet those lines again; All right and try to relocate my intersection points number 5. Suppose like there could be there well I would just keep on mind that these fives they get shifted. I would not bother to erase the number and now two intersection point number 7 should be lined there somewhere and on to this line and point 7 lies on p and q. So, this is where point 7 would lie and likewise over here. Let me name these points as 7. Three more to go. Number 8 need a horizontal and 8 lies on h and l. So, this would be 8 and this again would be 8. Intersection point number 9 goes from here and 9 lies on i and k so point number 9 here and here and finally point number 10 would lie on j, there I am.

So, if you realize all these intersection points they happen to be symmetrically placed about this vertical axis. As I said before; if you are looking at so if you are looking at the assembly of the prism and the cone from the top, you know this part is going to be visible, while this part is not going to be visible so this part is going to be hidden. So, if I draw a curve from 1 up till 6 is what I am going to see and from 7 onwards. From 7 onwards this part is going to be below the prism. So, they are not going to be visible but if I consider the cone or the the the prism having been subtracted from the cone; then this entire curve will be solid which is what the case was here.

So, having transferred all the intersection points perhaps; it is a nice idea for me to you know darken these lines representing the prism subtracted from the cone. Well, probably

give you a pretty good look. First let me work on the intersection edges and the rest of the cone, this comes out really nicely does not it there we go and finally, working on the top view is my intersection point 4 placed correctly. This is what the question is, should be placed over here, because if I if I project the intersection point 4, from here should be positioned over here somewhere and if I look at point 4 it should be lying on p and q. So, looks like 5 take it up go back. Yeah, I need to be a little careful with intersection point 4 lies quiet loss to 3, 3 seems to be alright, 4 does not seems to be ; so was it my drafter? Let me interval check, so if I take it up over there yeah.

So, looks like it was my drafter that made a mess of it. So, point 4 should be lying very close to 3 right there right there; So, this is point number 3 this is point number 4 would not be there. And if I extend that to p it is going to be here. So, 4 is going to be here just at the base of 3. Point number 3 is there, and if I verify that pretty much get it from here number 4 pretty much get it from here also number 4 just about that great loss to 3 ok. So, 4 is not there 4 is there. 5 is not here 5 is here. So, having said that may be let me sketch this curve free hand. I will have to get up from my stool make way for myself perhaps, if I do sketch this free hand I am using multiple strokes just to get an idea and then from 6 perhaps I should have locate it intersection point till 11 as well. So, 11 goes 11 lies on a and g and lies on this vertical. So, 11 would lie on a and g lies in this vertical.

So, perhaps if I can project 11 from here for that I need to realign my drafter, never have good idea to disturb the drafter once it is set. But for demonstration seems should be point number 11 was here somewhere just on the cone. So, if I take a projection point number 11 will be there and from here well it will be here somewhere ok. Let me name that intersection point. I should not be using my drafter any more, but let me name this intersection point is 11 both sides and then 6 11 7 and then 7 8 9 and 10. I have to see if a is positioned alright. Let me realign a drafter to the horizontal, 8 was here it looks like a is positioned alright.

So, perhaps it is going to come this way yeah. So, just to get an idea is to have the curve of intersections going to be looking in the top view. As I said had this prism been there then this part would have been visible. So, this part would have been visible from 6 up till 10, all these intersection points would have been shown using hidden lines, because they were going to be below the prism in the profile view ok. So, having said that but so since we are considering a solid that represents this prism subtracted from the cone. This

intersection curve will be looking like a solid. Perhaps, I can take a risk or maybe not first try to draw this using; you know thick solid lines slope here is going to be zero slopes here is going to be zero better. Yeah, looks good and finally, I will be using my sketch pen. Let us see how it goes, I will try single slopes. Let me set my drafter side a little bit and finally, this is how the intersection curve in my top view is going to look like.

I would have also love to draw this entire base of the cone using my sketch pen. So, that I would have given you very nice picture may be I will try that. I do not have a compass; well, I have a compass but I am not sure if I will be able to fit the sketch pen there, may be I will try that. Let us see how it looks should I or should I not touch the boundary of the cone. Well, this is how the entire things going to look like. Prism cut away from the cone; intersection profile in the front view, intersection profile in the top view and the entire thing in the profile view.