Technical Arts 101
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Lecture - 03
Think and Analyze

TA 101- think and analyze, but actually it is technical arts. So, this is lecture number three on orthographic views.

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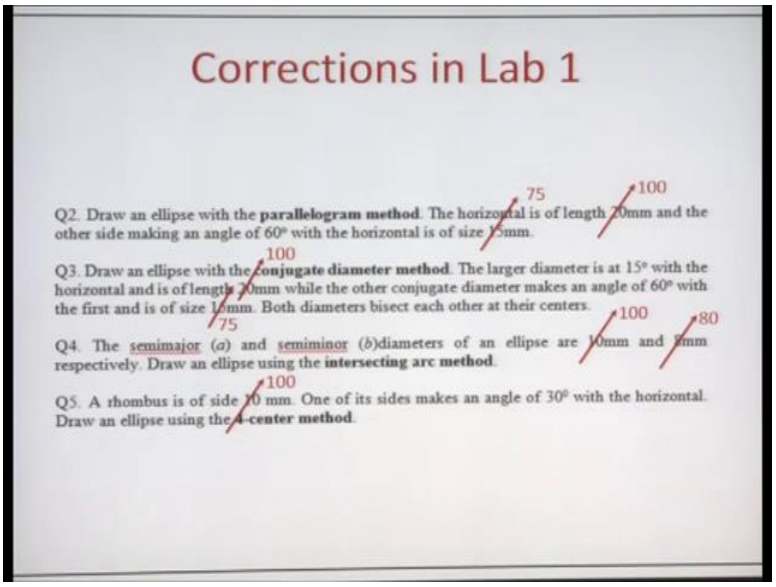

So, first few corrections in lab 1, so I realized that these dimensions are lot smaller for you to work. So, you might want to consider these dimensions, so replace 20 mm by 100 mm over here, 15 mm by 75 mm here, over there 20 mm by 115 mm by 75 here 100. So, 10 by 108 by 80 just scale it up and over there 10 mm by 100 mm, so these corrections, they should help you draw these ellipses better.

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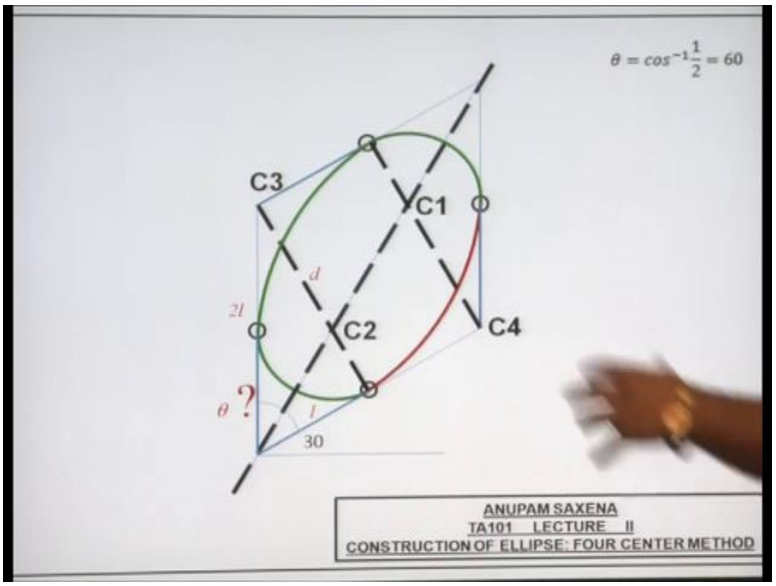

So, let me or let us revisit the construction of the ellipse using the four center method, so here we have a rhombus or let us say here we have phalogram. So, this edge is a 30 degrees with horizontal. So, as I said, the first thing that you need to do is draw the longest diagonal first and then from this vertex join or draw line segment joining the midpoint of the opposite edge from here. Again, the same thing draw line segment joins the midpoint of the opposite vertex. So, this center c 1 center c 2 with this is radius to an arch with this is radius to another arch over here center c 3 draw this arch center c 4 draw this arch over here.

Of course, this arch will be of radius this length and this arch will be of radius this length. Now, let us try to figure something out here, so this length is let us say l, so as I said this is a rhombus, so this length is 2 l, let us assume that this distance is d, now what is this angle there are here. Now, if you look at this construction carefully if you want this arch to be tangent to this line segment here and this line segment here. So, it so happens that this triangle here has to be a right angled triangle, so the core sign of this angle will be l over 2 l or theta would be the arch cosine of half which is 60 degrees. So, if this is 60 degrees this angel over here will be 60 degrees and this and these two angles are going to be hundred 20 degrees. You know just the other way around just the transformation, rotation transformation.

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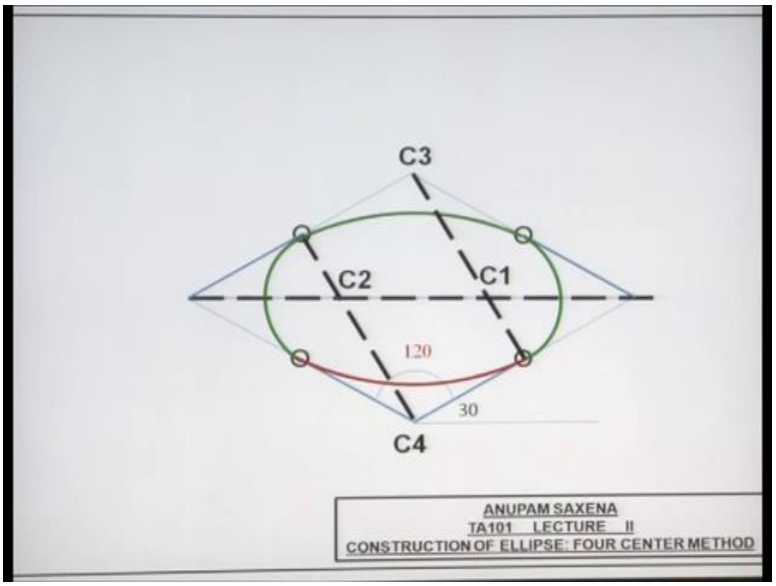

Now, this edge of the rhombus is at 30 degrees to its horizontal this is 120 degrees same thing draw the longest diagonal first from here join the midpoint from here join or rather from here join the midpoint. We will get the centers as c 1, c 2, c 3, c 4, you know the construction you can go ahead you know construct this proximate ellipse not a problem.

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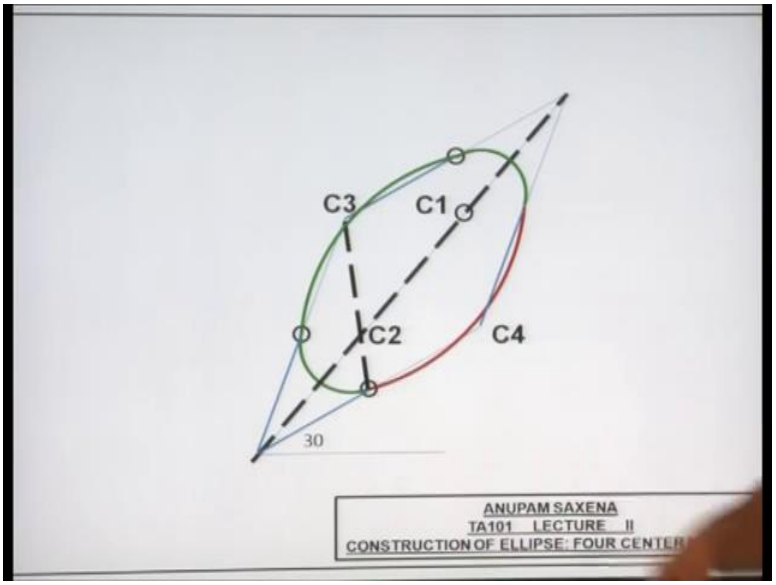

Now, if this angle is any think other than 60 degrees, then what happens? If you follow the same construction procedure, you know identify the longest diagonal from

here join the midpoint of the opposite edge from here join the midpoint of the opposite edge identify the centers four centers. You know complete the construction of the ellipse while happen is a part of this arch is going to be away or it is going to be lying outside this phalogram. This is something that you would not want and this would be exercise that you would be extensively when you are drawing circles as ellipses in isometric drawing or projects. So, this angle has to be equal to 60 degrees, otherwise this construction is not going to work, so let us get into orthographic projections second week third lecture alright.

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This is now my 11 year old, then I think he was about may be few months old enjoying, has quite a bit of task ahead trying to look at us and trying to figure well find orthographic views, what they are let see.

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So, we have the first object here, let us try to look at this object from different directions. So, let me take this object on to the top right corner of my screen, let us look at this object from this side, how does it look?

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This is how it looks, actually here a rectangle and let us look at this object from the top, how does it look again pretty much like a rectangle. If I look at this object from this side looks like a yeah, let us take another object and let me take it back to top

right corner again and again try to investigate how this object looks from the three sides.

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If I look at this object from this side looks like a sector, there is the shukla [FL] behind the object. He is not the part of the object definitely. If I take a look at the object from the top how do think this object going to look like?

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Well, you are right looks like pretty much like a rectangle.

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If I take look at the object from behind, again looks pretty much like a rectangle.

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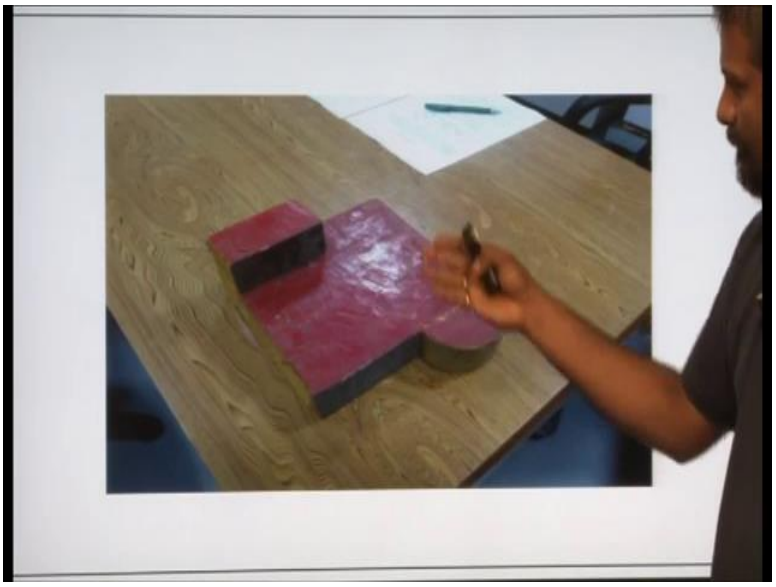

The third example more complex, you know this object is basically a flat plate over here a rectangular block over there, a semicircular block over here, all glued up together in that fashion.

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So, if I take look at this object from this side, how does it look to you? So, it is look like a rectangle here and this would also show up as a rectangle pretty much like this a bigger rectangle and a smaller rectangle and there would be a rectangle corresponding to this block over here on the top. So, ignore all the other entities behind the object yeah anything else possibly not. If I take a look at this object from the top, how would it look to me? So, corresponding to this main block, I will see a rectangle and with regard to this block, I will see a rectangle somewhere on the top left of this one and with regard to this semicircular block over here, I would actually see a semi circle pretty much like this.

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So, you have this rectangular big block and a small rectangle here and a semi circle here.

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If I take a look at this object from behind, how would it look well, so this part would show rectangle, this part would again be a rectangle and corresponding to the top block, and we will see a rectangle over here. Well, these are actually not perfect rectangles, why because you know the eye is very close to the object, it is not very far,

but if the eye is quite far from the object, you would probably not see the top face as you see in this figure or else.

The point I am trying to make is let me go back here the point, I am trying to make is you know of you have any object at hand. If you try to look at this object from three mutually perpendicular directions or it is orthographic. You essentially get different impressions of the object or about the object and orthographic projections essentially pertain to those impressions that you have if you look at this object from three mutually orthogonal directions.

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This is the first direction, second direction, and third direction.

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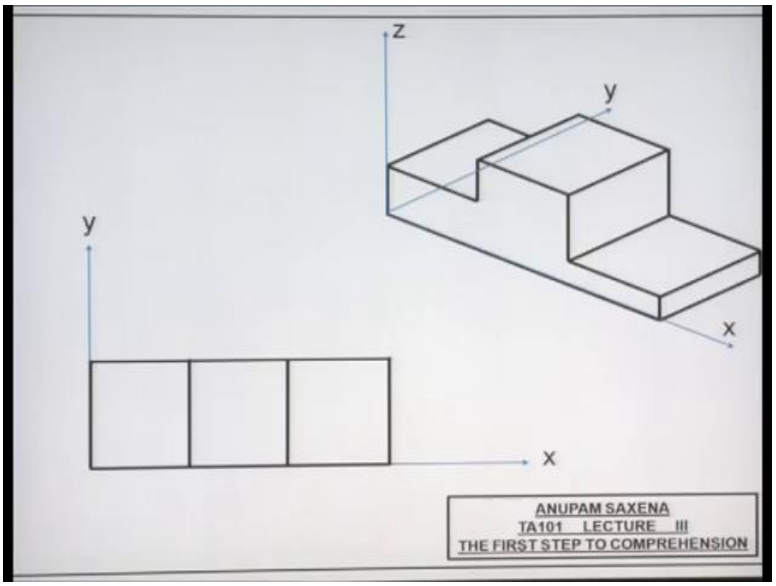

This is the first step to comprehension, so given an object, what you do? Let us take an example so this is a victory stand gold, silver, bronze, just an example. So, it is a very nice very simple example, so it is easier for me to locate the three perpendicular axis. Let me call this axis as x that one is y and third one is z and if I want investigate how this object looks from different directions again. So, the point is that I am trying to capture the impression that this object is going to be giving in three mutually orthogonal planes you know in this case x, y, y, z and x, z.

So, the first thing that you know if I take any object, you know I feel like you know rotating translating to whatever with this and trying to look at this object from different angles. Here, it also happens that only three angles are adequate for me to completely describe this object, something very similar here. So, probably we have would be rotating this object about the z axis and see how the objects look like on the x axis see how the object looks like on the y axis and you know get the impression of the object.

So, let us do this first, let me rotate the object about the z axis and try to figure how the object looks like. So, if I rotate the object about the z axis which plane am I looking at I am looking at the x, z plane.

So, I am looking at the object from this direction, so let us draw the axis, so when you are going to be drawing the orthographic views I mean this just for your

understanding this just for your comprehension. Essentially, when you are drawing the orthographic views you will not be drawing these axis is just for you to understand, so let us look at what we see on the x, z plane do we see this edge.

What for this edge correspond to it would correspond to bottom edge of the object how about the vertical edge. Here, this would correspond to this edge of the object how about this edge, they correspond to this edge, and then the vertical from here to here and then another horizontal will corresponds this edge vertical downward. Here, a horizontal downward where rather vertical downward upward from here and then a horizontal that would represent this edge, do you see anything else possibly, not how about if we rotate this object about the x axis and what we see? What we see essentially, how would be object look if we place our eye over here from the top, so we are looking at now the x y plane.

Here we go what would this edge correspond to this is essentially be corresponding to this edge this edge and this edge together. So, if this edge would essentially be appearing as a point somewhere on the edge here, and this vertical edge also will be as a point somewhere on this edge now what for this edge correspond to your right. So, it quite be this edge and then this would correspond to the edge over here the vertical over here we are not worried about that, because show up as a point, how about this edge? So, essentially will be extending this edge further this vertical again will show up as a point and this edge would essentially be shown like this.

Then, how about this edge here, and essentially we will get an outer loop anything else yeah so you will be seeing this edge as well and this edge as well. So, this how the victory stands gone be looking from the top now how about we rotate this about the Z axis and try to look at the object from this side, you know standing over here what do we see? We are essentially going to be looking at the y z plane.

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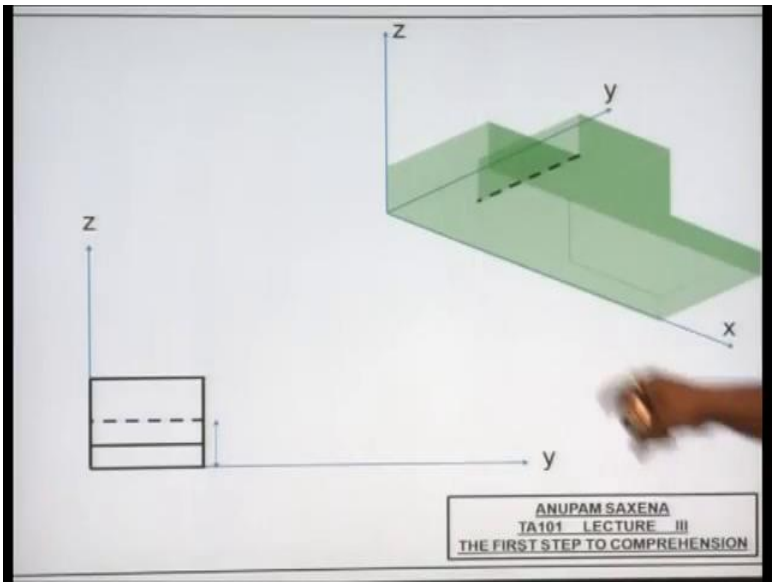

Here we go with the y z plane what you see you will see first this edge then the two vertical edges, then this edge essentially over here. So, this loop as represented over here, and then about this part we will have another vertical edge this one over here and the horizontal edge there representing this loop. Now, with that be anything that you would be seeing from this side yeah possibly not now. What if I tell you that let this not be solid box, but the box made of say glass, so instead of just being solid box this actually a transparent box. Now, focus on this edge would you be seeing this edge looks like you would be and this edge would at some height different from this edge.

So, we already have captured this edge here and this height is different and since this edge is not directly visible to us we are going to be using a connection. We are going to be representing that using a dashed line all the other edges which have visible to us they have being represented as solid lines all the features not directly visible to us, but they are going to be visible. They are going to be depicted using dashed lines, anything else possibly not because this edge is concealed behind this edge, this edge here is concealed behind this edge, you know and this edge is actually hidden behind this edge so we are fine.

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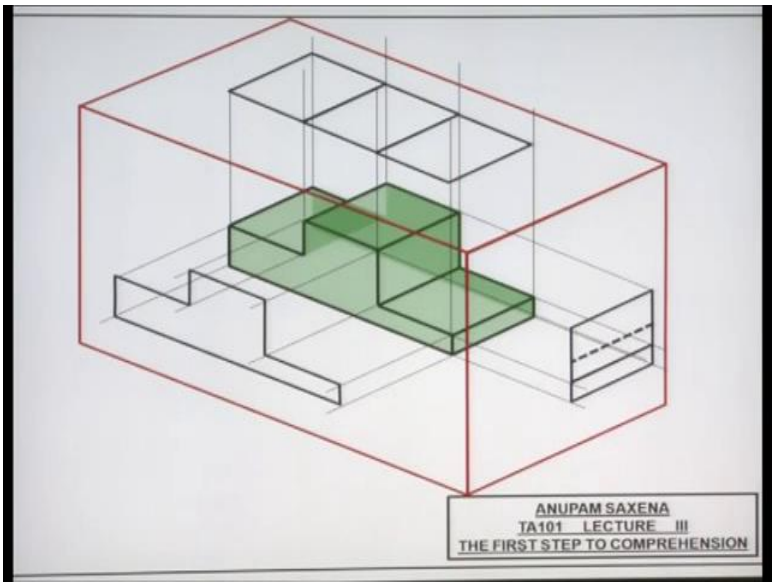

Now, so let us imagine that we have an object over here, and that is enclosed by let us say a glass box or a box or may be just three planes. You know this vertical plane here the vertical plane here, the horizontal plane here and all these three planes happened to be mutually orthogonal or perpendicular to each other. I just follow the animation, I just imagine that we have light bulbs on all these edges. They are emanating light in such a way that this light is essentially going to be going in three mutually perpendicular direction along this direction along this direction and along this direction.

So, there are special thanks of light bulbs, so if you look at the rays which are parallel to this edge you will essentially we having this loop getting captured on this vertical plane. Likewise if you have rays emanating from these special light bulbs along this directions, then you will have one loop getting captured there, and another one there and the third one here. In case the light is parallel to this edge from, you know this sparks essentially you will be having this big loop getting captured the smaller loop getting captured. If you look at this edge over there it is kind of not visible from this side, but still there is always a nice idea to represent what is also not visible, but there, so even this edge it is going to be captured.

So, the object from this side it is going to look like this, the object from the top is going to look like this the object from this side it is going to look like this, you do this exercise at home, so it is pretty simple exercise for you.

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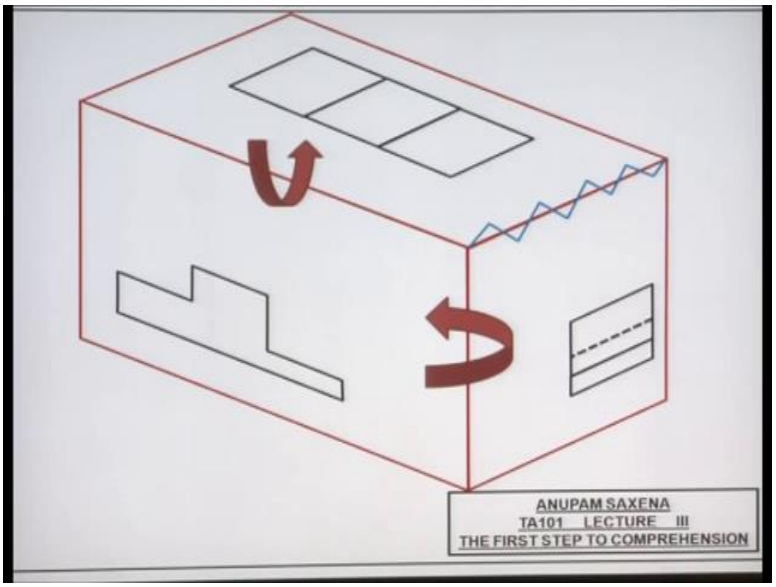

So, once we have captured these images from three different directions, I will grip this edge off and I will rotate this planes. So, that they happen to line the same plane to, so if I rotate this main about the essential line and if I rotate this plane you know, so this vertical plane is like here the horizontal plane is like this. I am rotating the horizontal plane like this and this one over here I am rotating it you know like this, so if we flip these planes so that they lie on same to dimensional plane.

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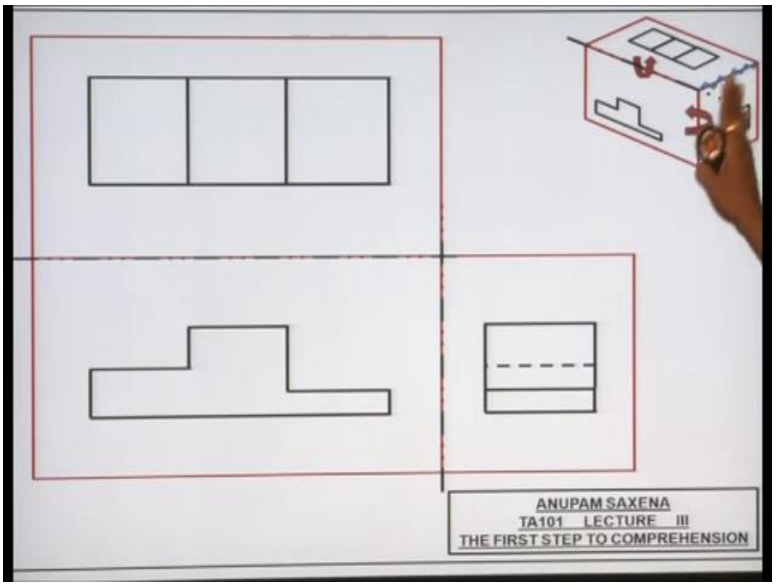

Let us see what you going to get, so this vertical plane will be over here the horizontal plane is going to be on top of the vertical plane and the right hand side plane. The plane in the right hand side will be over here on the right hand side, this vertical plane alright. So, we will see this part over here these three loops over there and this part over here. So, this is the front view if we are viewing the object from this side the top view if we are viewing the object from the top and the right hand side view if we are viewing the object from this direction. So, this is the hinge line that separates the horizontal and vertical plane is one here and another hinge line that separates the vertical plane and the plane on the right which is this hinge line.

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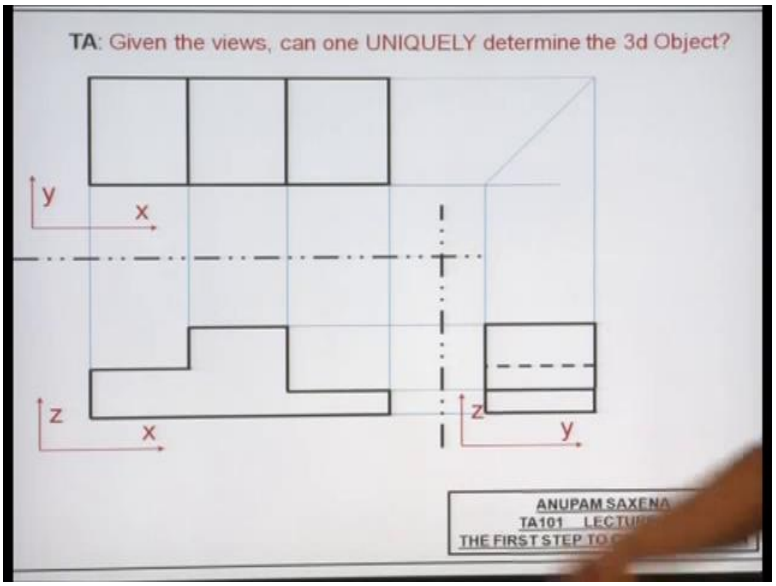

So, let us get rid of this planes and this is how we are going to be you know seeing the representation of the object in three different directions. The object, the three different views of the object, so these are the orthographic views of the object, first this was the first exercise on orthographic views for you. Now, let us try to correlate different edges of the representations in the three planes. So, you know of course these and the edges where they get correlated, so what these, these and these and we correlate the edges and in these two views, we will have this correlation. Here, this correlation this correlation and if you look at this edge this edge we will get correlated to this hidden or dashed line there.

Of course, there would be correlation between the top view and the right hand view as well, now try to figure what angle this is guesses. This would be precisely 45 degree why because this distance is the same as this distance, so that is the x y plane the top view the x z plane the front view and the y z plane the right side view. As I said before you do not need to in fact you will not be requiring to depict these planes in your orthographic views this just for your understand just for your comprehension. So giving the views, so by the way, I make a lot of mistakes, so there is this projection line which is missing over here anyways.

So, think and analyze this is the question for you, so giving the views can one uniquely determine a three dimensional object for you to answer and a related

question, do I need to have all three views? So, the answer this question yes do I need to have all the tree views to be able to uniquely represent a three dimensional object or in all cases or perhaps in some cases only two views would be adequate.

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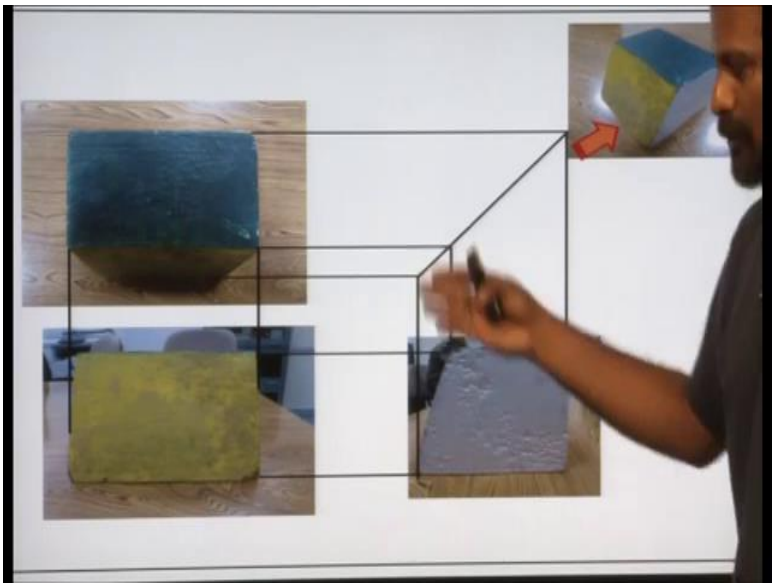

Going back to the examples that we were discussing you know a while ago, so this object if I look at this object from the front this is about the view as from the top this is about the view as and from the side, this is how the object looks like. We correlate using the projection lines, you know this is how you would to draw these projection lines.

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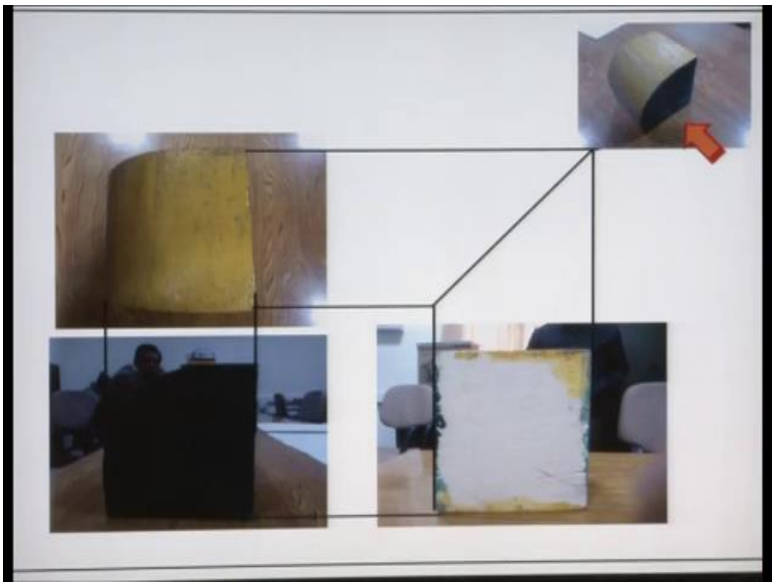

Second object, the front view, the top view, the right side view and if you correlate different features of these objects in different views, this is how your projection lines are going to show up in your drawing.

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Third object if this is the front view this is how the objects going to look like in the front view the top view and the right hand side view. If you again correlate the different features of the objects in three different views, this is how the projection

lines are going to look like in every instance, this angle or this line will be making a 45 degree angle with the horizontal line.

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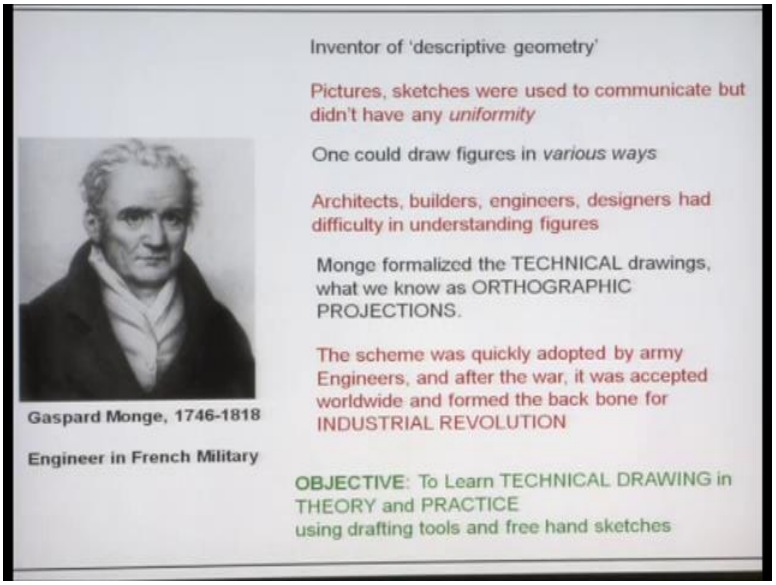

So, if you recall, I had talked about Gaspard Monge, engineer in French military was the inventor of descriptive geometry and he was a person who you know could form a lines drawings by means of orthographic views. So, this is the thing which is of important to us Monge formulize the technical drawings what we know as orthographic projections.

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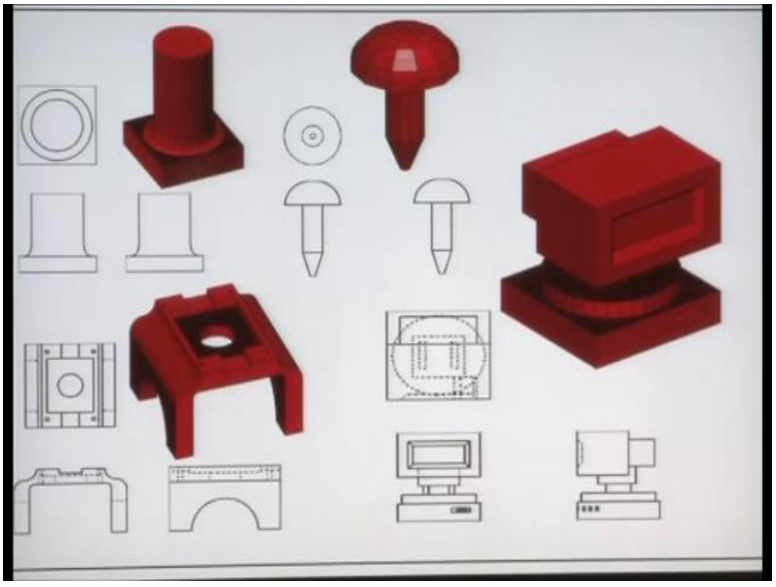

You are given the three view of different objects, it is possible for you to reverse engineer and you know try to estimate how not try to estimate or predict, but try to actually exactly know what the objects is going to look like in three dimensions life. In this case, for example, if this is the front view the top view the right side view this how the objects looks like, now it is just a pen front view top view the right side view, this is how the objects looks like. It is pretty much like a stool front view top view the right side view the objects and the front view of a personal computer the top view, the right side view, this is how you know 3 d objects what look like.

So, it looks like if you are given these three views it looks like a say I mean I could be wrong and something that you need to answer for yourself. So, given three views given three orthographic views, it should be possible for you to exactly of extract the three dimensional information of an object. So, this was an exercise that one of my students Amithesh Mishra did quite some time ago probably 2005, 2006, he did a fantastic job.

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One thing I would always emphasis throughout this course sketch, sketch, sketch, sketch, sketch, sketch, sketch, sketch, sketch, and sketch, and sketch. Keep sketching because that is how you practice the more you practice the better you become in drawing always a good idea to sketch before you start representing an object via it is orthographic view and other views as well.

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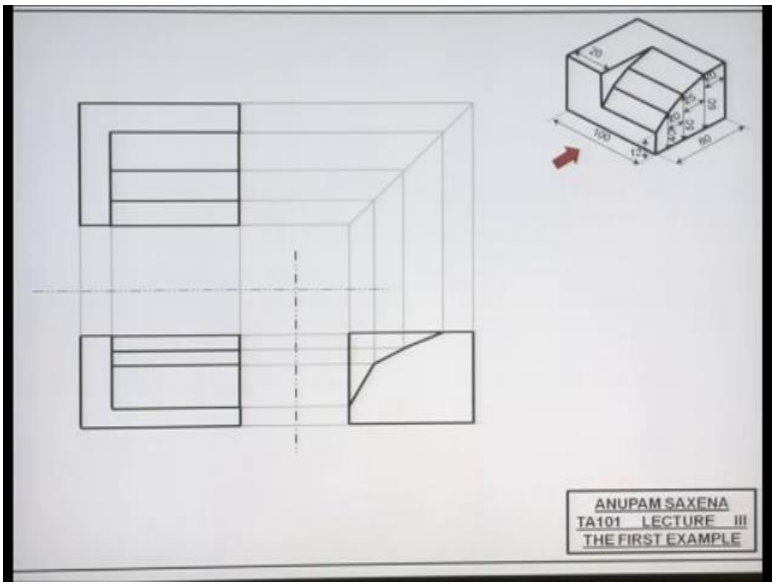

So, let us take an example, so this is a three dimensional object we have this is about 100 units millimeters 80 millimeters, the height is about 60 millimeters over here. So, this is a you know feature which is cut from the block and we would like to represent this objects by means of orthographic views let us see how. So, the arrow means that this is the front view, so the moment this the front view in the third angle projection we are going to talk about that later. This would become the top view and this would become the right hand side view, so with the front view given how would the object look like if we visualize the object along this direction again.

So, mark the way i am representing these adjusts or this I am just constructing, I am not constructing the final drawing at this time. So, if I am using construction lines, I am going to be using a two edge pencil or two edge led ensuring that my lines are very tempt so visible. So, this horizontal edge would correspond to this edge the vertical edge would correspond to this edge if I look at to this object along this directions this entire feature will be represented why this edge. Of course, there will be a horizontal edge sky here always a nice idea to start with the bounding boxes in the corresponding view. So, this actually is the bounding box for the front view let us also draw the bounding box in the top view, so the length is 100 in the top view.

I am going to be representing this edge, so it is about eighty so this block is 100 by 80 and I will draw a vertical hinge line separating the front view from the right hand side

view I will draw the projection lines. So, this height is 60, now this length would correspond to this length over here which is this length it is about 80. So, this the bounding box of the object if I am visualizing it from the right hand side. So, this first box is hundred by 60 in dimensions the length and the height, so once I have identify the bounding boxes, let us try to sketch all the features after of course I complete the entire schematic including the projection lines.

So, this edge is this one vertical edge is this one and then this is about 20 from there, then I am going down I am going up from here, I am going left over from here. So, what would be this length it is about 80, and then I am going vertically upper, now what is do I see? I see these steps at heights 40, 50 and 60, but we come back to that later, let us try to look at the object from the top, I have gone this edge. Now, always a nice idea to work with the projection lines because you are kind of sure which entity is a which features of the object you are representing and which over view. So, I will project this point upward, and then I show this edge and then I am going to show this edge over here.

I will come back to that later showing this edge here this edge and then I am going to down from here to here this edge alright and an of course, this edge is going to show like vertical edge in the top view and of course this entire things. So, this edge would be this and this together, now this one here corresponds to this edge it is about 20 plus 25, 20 plus 25 downward. Then, I have got this edge right there, which is 20 further downward, so looks like I have been able to capture all features of this object in the top view once I have done that I will start using my projection lines. I am working with the right side view, this edge, this edge here, this edge here and then I am projecting this feature on to the right.

Again, that feature and this feature all this three features, and then I am going to be projecting these features downward, I am going to mentioning that I maintain the heights. So, this height is about 60 this height is 50 here, this height is 40 here. Correspondingly, I will go to the front view and draw these lines finish the vertical edge which would corresponding this edge in the front view. Of course, I should have drawn these projection lines a little earlier.

Then, I will finish of the right side view am I done yet? Must be not because I am missing this edge and this edge there I go anything else I am missing you know the lot of chances that you going to be making mistakes when you are drawing. You know when you are working with these technical drawings, so these projection lines are going to be helping you out in identifying those mistakes. So, if you are missing any feature in any one of these views after you have drawn these projection lines, you will not be sure what you have missed. So, quite to be a little careful you have to be very careful and sketch, sketch, sketch, sketch, sketch and sketch practice and keep practicing this is what the golden rule in technical drawing says.

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Alright, relax, keep thinking and analyzing.