Engineering Drawing and Computer Graphics
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Module - 06
Lecture - 50
Isometric Projections (Contd.)

Hello everyone, welcome to our NPTEL online certification courses on Engineering Drawing and Computer Graphics. We are learning Isometric Projections.

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So, in the earlier classes, we have seen a different kind of projections as orthographic oblique and perspective projections. In that, a very popular method what we are learning is isometric projections.

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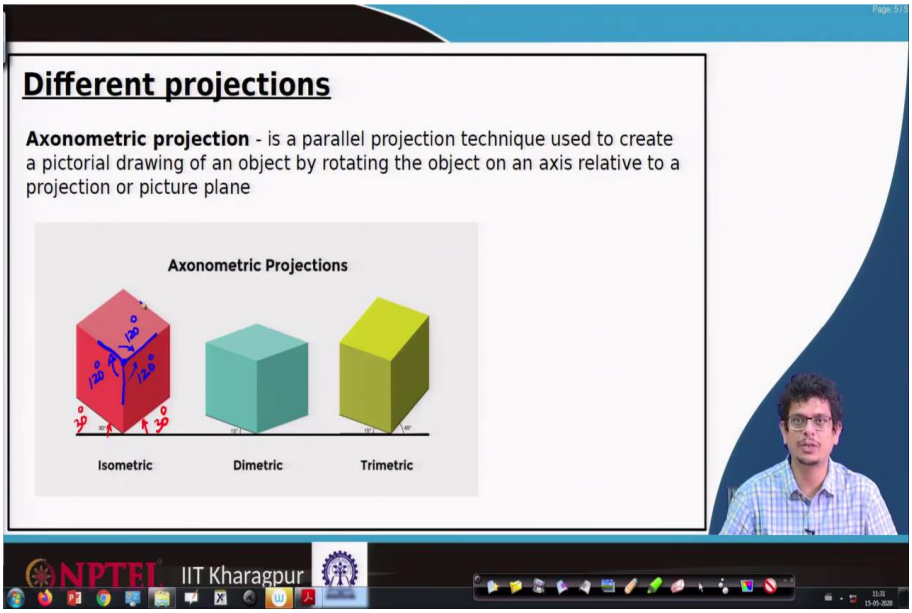

So, isometric projections come under the part of axonometric projections with parallel lines we use it. And the main concept of isometric projections is, with the horizontal one of these base will be at 30 degrees on both sides and the principal axis makes 120 degrees angle with each other. And especially we will learn this isometric box method in using an example. Where the views are embedded in a box and try to rotate so that, we will see isometric projections.

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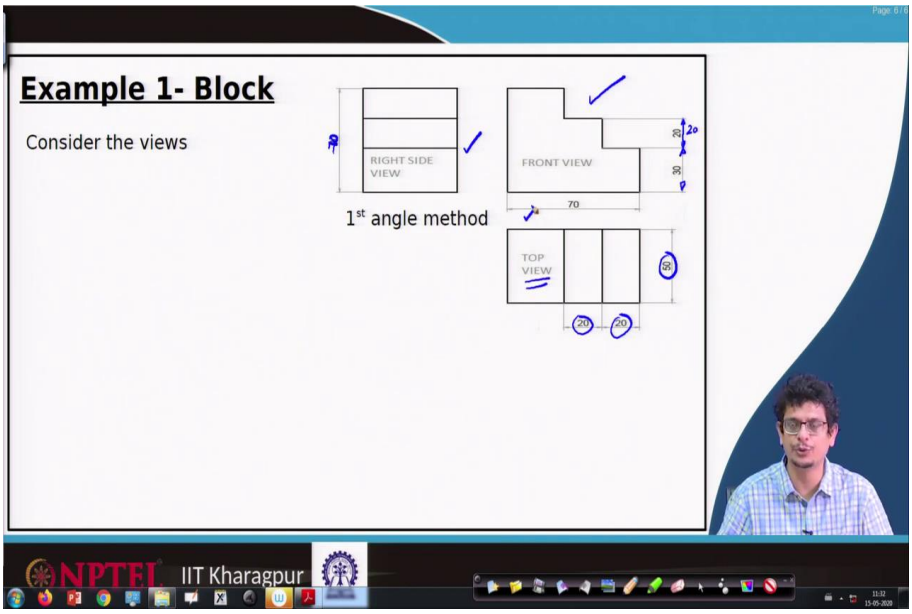

So, let us take the first example of three different views using the 1st angle method. We have something like a front view, having certain dimensions like steps kind of architecture, some 30, 20 units and its right side view is given with total height 70 units and the top view is given with dimensions 50, 20 and 20. The remaining dimensions we can get it from the other views.

So, if these views are given, can we guess how an object in three dimensions looks like and especially can we draw that object using the isometric projection method. Can you take a look at it how it might be in three dimensions?

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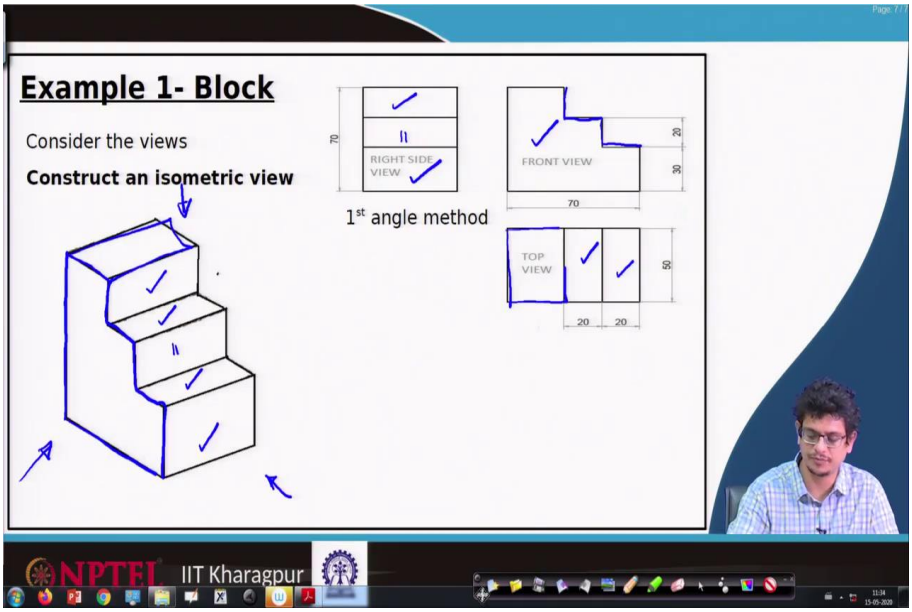

So, the object looks like a staircase step. So, these stairs, we can see it in the front view when we are looking at it. These are the steps and the box goes all the way in this way, that is the front view what we are discussing.

Similarly, in top view, the object what we can see in this block. Similarly, this block is that and this one is that and right side view if you are looking at it, from right side dimensions we will try to look at. So, this one is this, this one is this and this part is that. Now, how to draw such kind of isometric projections?

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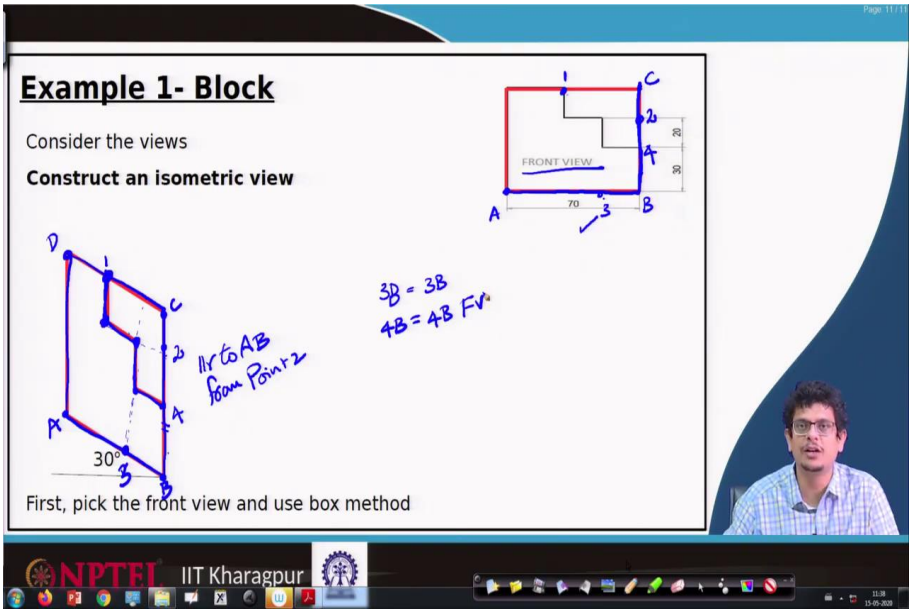

First thing, what we have to do? Enclose your front view. Whatever the dimensions give you a maximum idea about the object that one we will take it and start constructing these isometric views. So, from the front view, there is an object with steps. So, first, we have to enclose this entire object in a rectangle, that rectangle is shown in this way.

And for isometric projections, what we have to do? First draw a horizontal line, with respect to that horizontal line, construct a 30 degrees line that line matches with this blue line. So, first, draw that one in that way. Now transfer this point A B to A B these lengths are the same because these are the principal axis lines parallel to principal axis lines we are picking.

So, A B here at the isometric view A B here from the front view remains the same. Now from B drop a vertical line, that is this one let us call C. The length C we will get it from the right side view, 70 units which have been given. So, whatever the B C length is there the same B C length we will draw it.

Now, parallel to B C from A draw one more line D and connect C and D. On this box, the 30 degrees angle whatever it is making, measure this point 1 C to 1 and locate that point 1. Similarly, measure this 2 point from B to 2, whatever B to 2 points first locate B 2 point.

Similarly, from B locate the third point. So, somewhere locate the third point. So, here 3 we have, here we have 2. Now drop a vertical passing through this 3 point and similarly drop a parallel line parallel to A B from point 2.

So, wherever it is intersecting connect those lines so that, we will have this block. So, from C we have located 1 drop a perpendicular line, from 2 drops one more parallel line to A B so that it goes intersect here. Similarly, it goes intersect therefrom 3 drops a perpendicular line in the vertical direction so it is going to intersect here, it is going to intersect at this point from B. Measure this length call this one as 4th point.

So, let me write these numbers 3 B in isometric is equal to 3 B in that view, in the front view. Similarly, 4 B in the isometric view is equal to 4 B or B 4 in the frontal view. Similarly, we have to track it each of these points so that, we will be in a position to join that by a line. This is the way we transform that entire front view into isometric projections.

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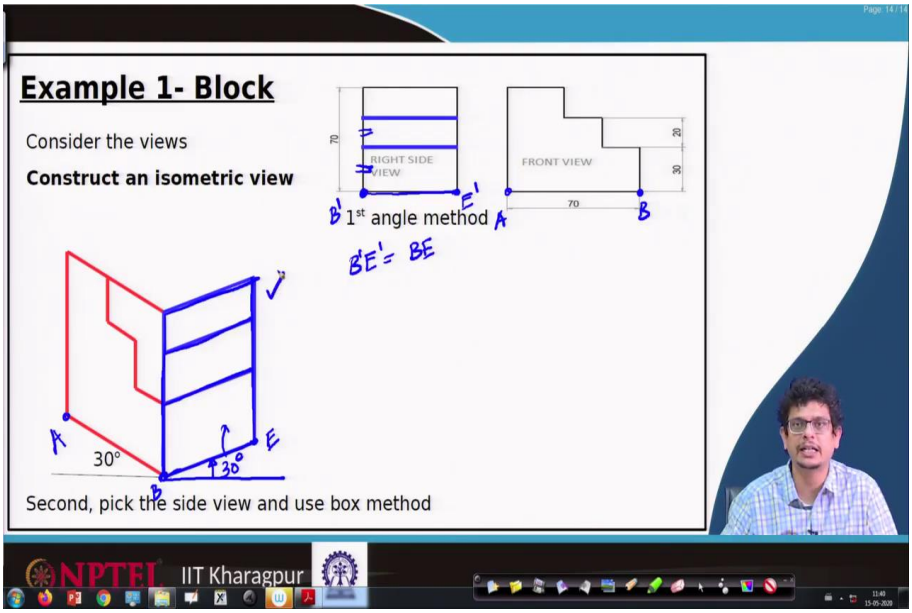

Once that is done we will pick the right side view. So, from the rightward direction, we are trying to locate it in this way. So, already it is a rectangle, transfer this rectangle onto a 30 degrees line. Again this is a 30 degrees line, this point we called A, this point we called this is A, this is B. When we are looking at this point and B point coincides, let us call B prime.

So, using B prime, whatever the length in the right side view we have that length first we have to transfer it, complete the rectangle measure length of this line; similarly, measure lengths of that line. So, at those locations draw two lines parallel to this one, let us call this point as something E. So, B prime and this is E prime. So, whatever the length of B prime, E prime, that is same as B E. In that way construct this rectangle.

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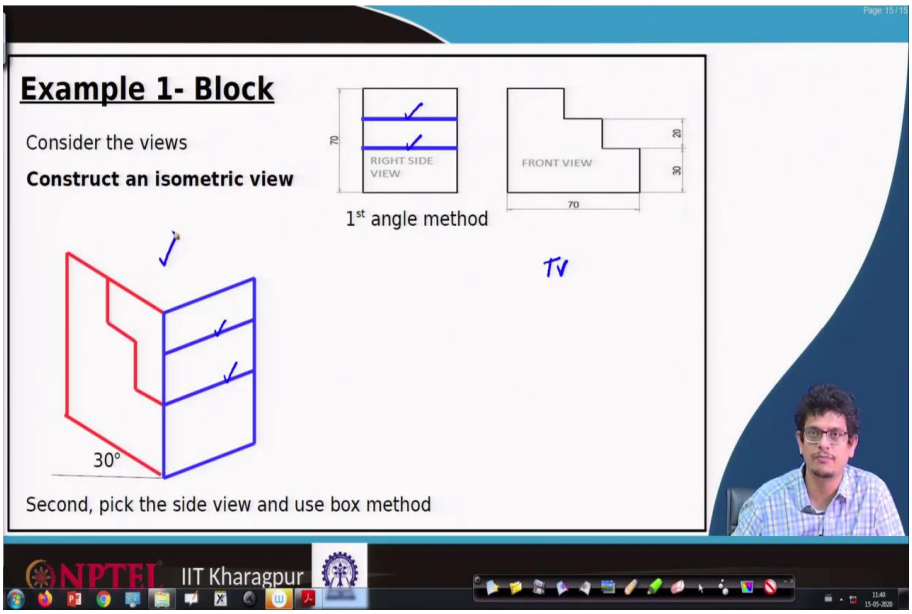

Along with these lines, once it is done we can use the other view top view to construct the top side of this box. So, let us look at the top view.

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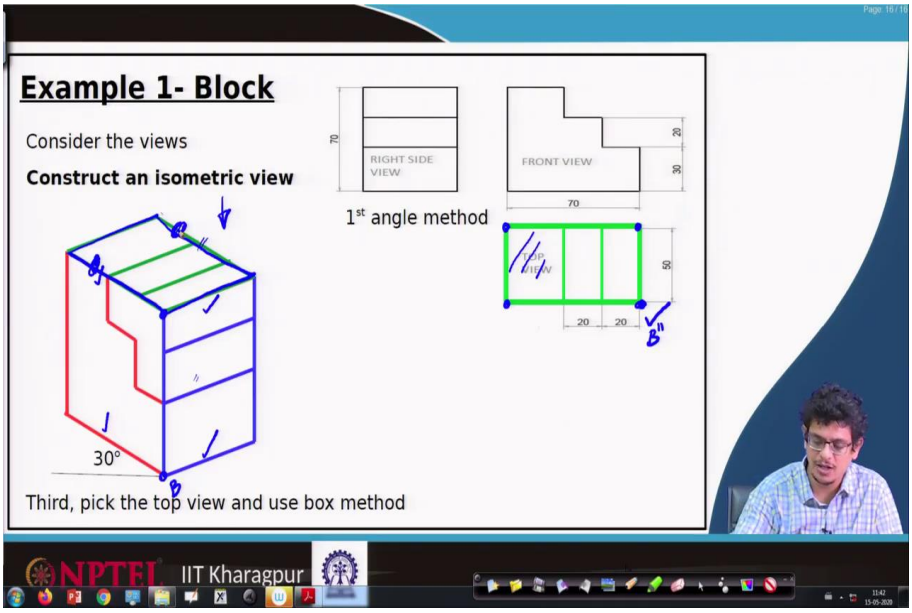

So, as I said we have this kind of blocks, transfer this entire thing using our isometric axis. Now, this point comes at the top side, we are looking from the top side of that. So, these are the points what we are going to see, the points which are going to match with our earlier P point is this.

So, B here B double prime matches on the top side; so, with respect to that draw a rectangle. We have to turn this rectangle parallel to these lines so whatever, this initial line we have parallel to that we have to draw it. Similarly, parallel to this line we have to draw this one.

On the top side is basically, if I am going to complete a rectangle whatever that line we are going to have parallel to that. Otherwise, parallel to this line also parallel. That is the way we have to join these rectangles.

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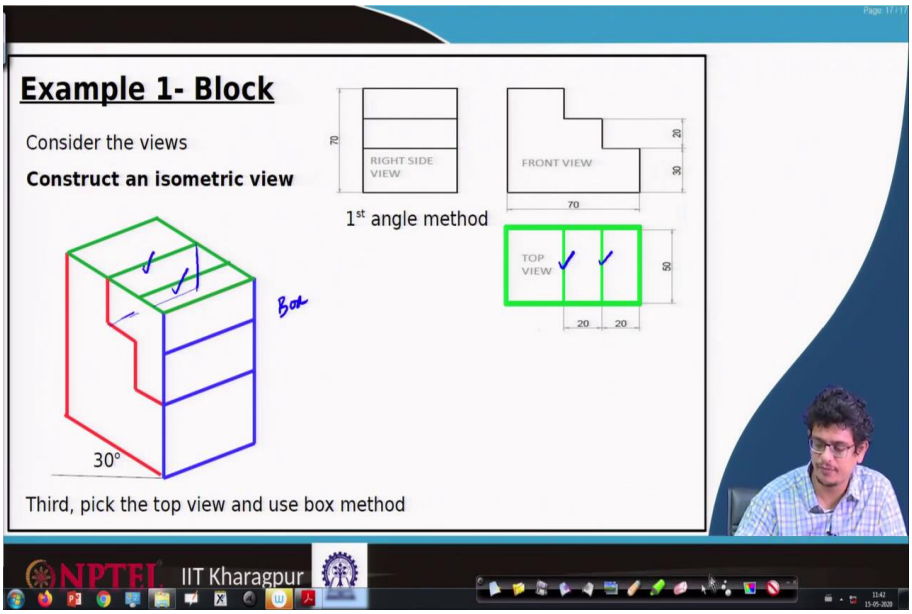

Once it is done we have a box, rectangular box, where these lengths have been transferred. Now, because these are from views, this line coincides. So, we construct a line parallel to that dropping through vertical. So, let us look at that solution.

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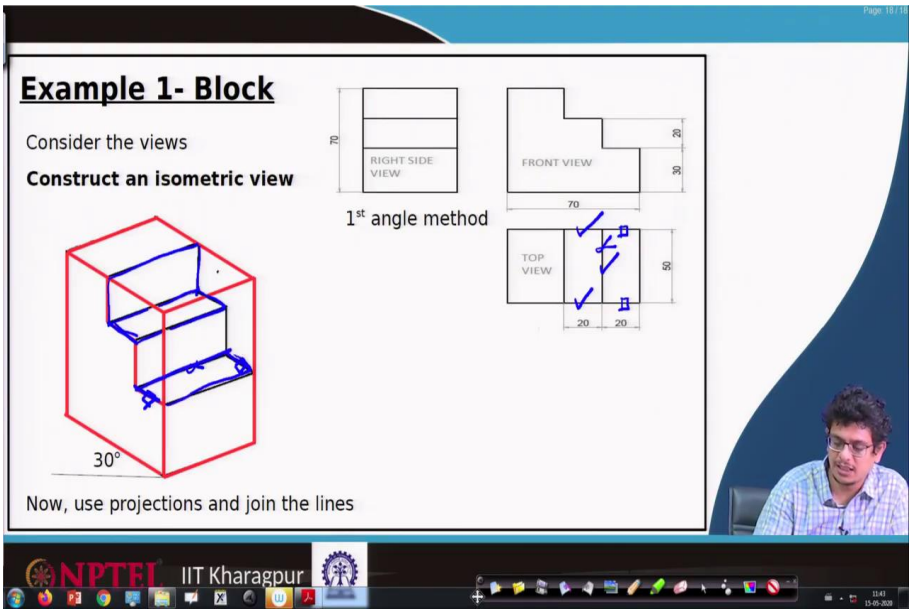

So, those lines what we have seen the top, this one and this one coincides with each other. So, we complete that entire rectangle. Once that is done we have this line, which is matching with this line. Similarly, we have this length parallel to this principal axis we connect it, this one and this one once that is done. We pick this these two lines, draw it in this way and this line coincides with this line.

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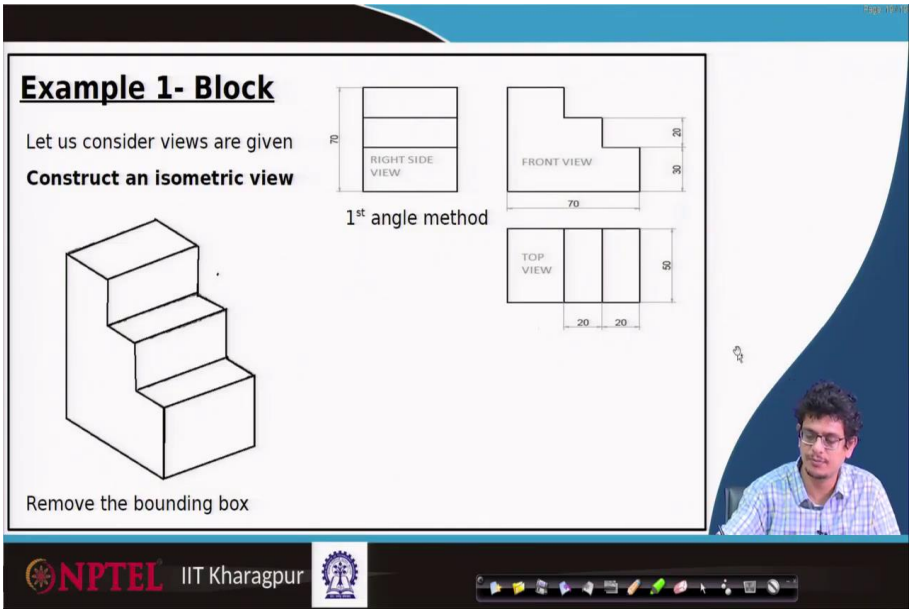

Once it is done, we finish these lines remove that rectangle. So, using this way we will be in a position to construct isometric views of given projections.

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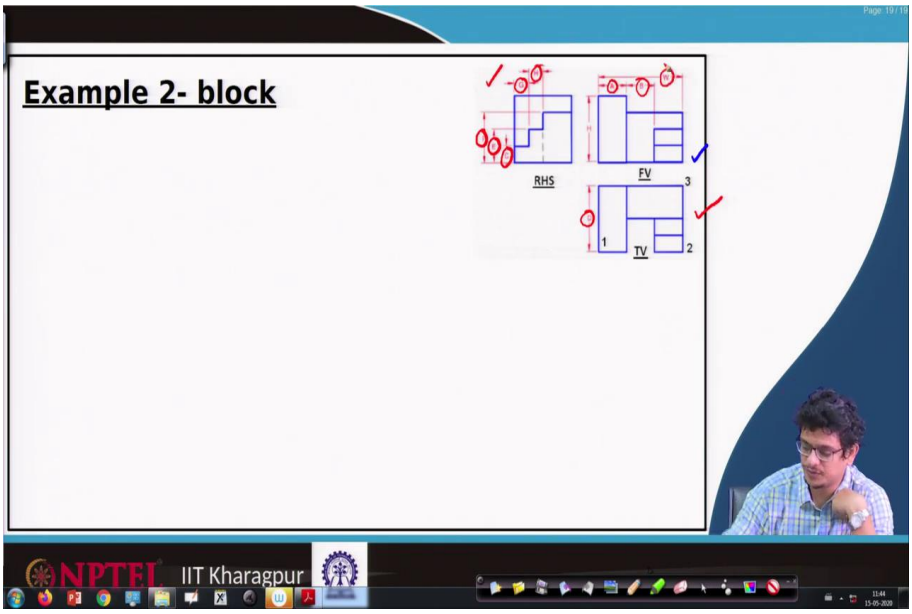

So, let us take one more example to understand these isometric views. We have given three views, the front view, the right side view and the top view with certain dimensions these dimensions can be 1, 2, 10 and so on. So, here instead of that, we are denoting it by letters. With these lengths we have to construct a box, so let us see.

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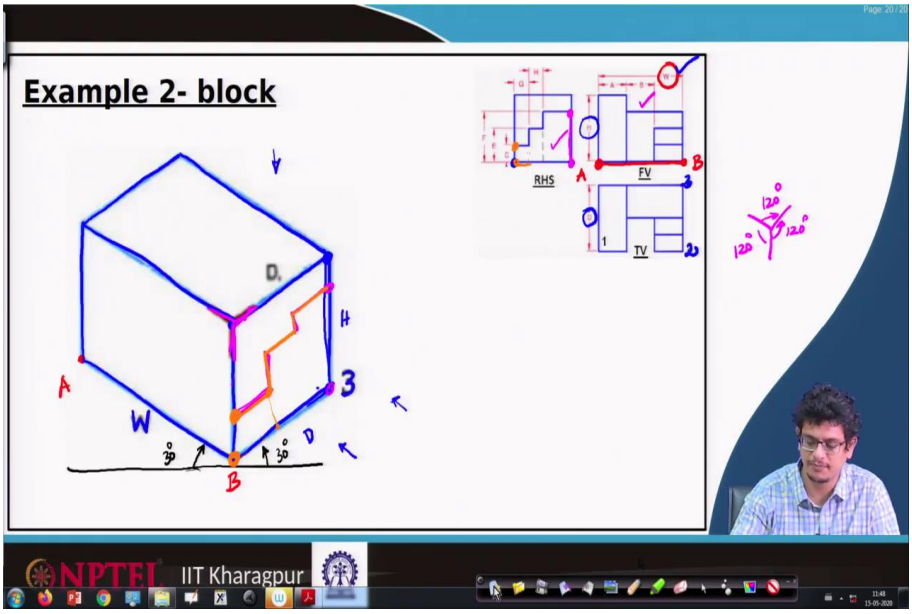

First of all, whenever we have such kind of objects where rectangles are the dominant features we go ahead construct a box, using principal axis. Now in the front view, we have this length A W. So, if we are seeing from this point let us call A B, the length A B is W. So, from A B we draw a horizontal

line first, first of all, we draw a horizontal line, with respect to that 30 degrees here and with respect to that 30 degrees.

We draw two lines, once these two lines are drawn one is W length matches with this one and there is a B 3 length, which we can see it only from a right side view; that means, from this point to this point the length whatever it is there that we have to draw it.

So, from B to 3 which we will see it from the top view when we are looking at the top view, the B 3 length is quite visible, in terms of 2 to 3 point. So, that length is D. So, with D length, we will, first of all, locate point 3.

Once it is done from B, drop a perpendicular once 3 is also known to drop a perpendicular, from A drop a perpendicular. Now from the right side view, we can see the vertical height of that so the vertical height of this object is H. So, with H length we will connect these points and join it like a box, always parallel to our principal axis

Here the principal axis can be taken as these edges are the principal axis. In two dimensions if we are seeing that, it makes 120 degrees angle, in between these sides. Once the box is constructed, we can transfer these lengths from the front view and also from the right side view.

So, the first thing what we can do is straight away, pick this right side view something like steps are visible. So, step construction any line supposed to be parallel to this principal axis planes, we have to do. So, this line parallel, now this line parallel with another principal axis then go ahead and draw it, by transferring suitable lengths from this point to this point supposed to be from 3 to this point.

Similarly, from here to here whatever that length is there, we have to transfer that length here and from this projection, we know this length. So, from here drop a perpendicular to connect it so that, we will be in a position to join these by lines.

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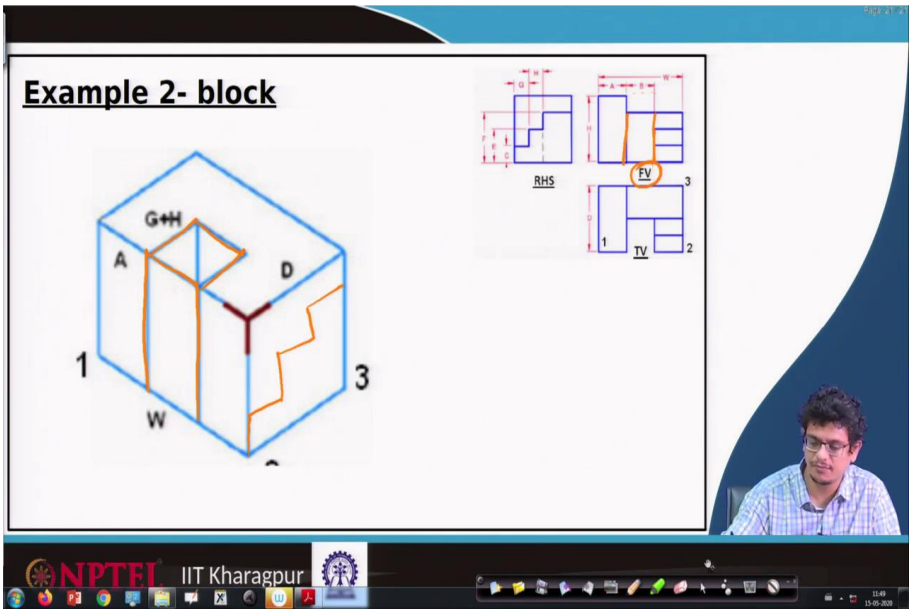

Similarly, we will transfer these lengths on other planes also. One of the possibility is from the frontal view, we can see that there is something like this kind of block, which is imaginary, so we can join along with our this one. From the top view we can see that this part is present so this one, these are the parts of the steps which we can see it part of the steps.

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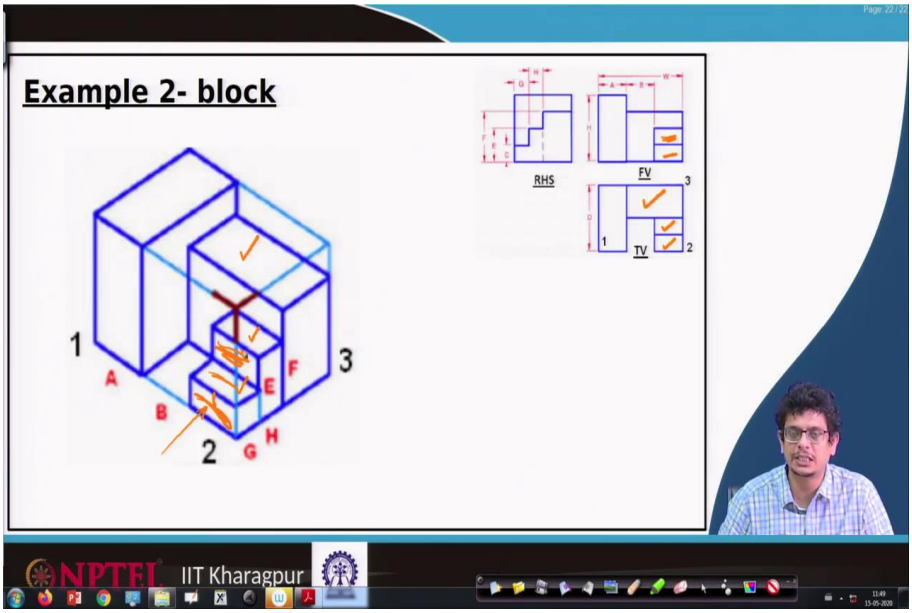

Similarly, from the front view, we have those parts, from similarly front view we have these parts, in this way we can construct our isometric drawing. So, first of all, one has to visualize the views carefully. The way views are there on principal planes, these are the principal planes.

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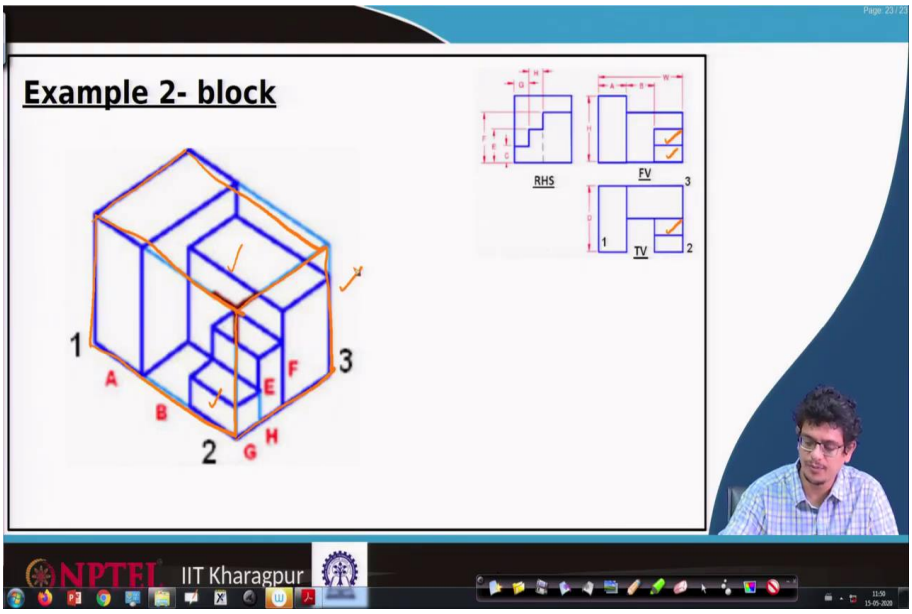

For example, for us draw those projections. Once these planes are available, transfer these lengths onto this geometry, similarly from the top view when you are looking at it drop these lines. So, that a complete isometric projection one will be in a position to get.

When we are learning about computer graphics we will see, how easy it is to construct such kind of isometric projections and views. But the basic concepts behind these isometric drawings are first of all identifying these principal axes, principal planes, suitably transferring these lengths from each of these views onto these principal planes, through an intuitive approach we will join remove the lines and get the object. Once we construct that, we have to re-verify it whether that is matching the views.

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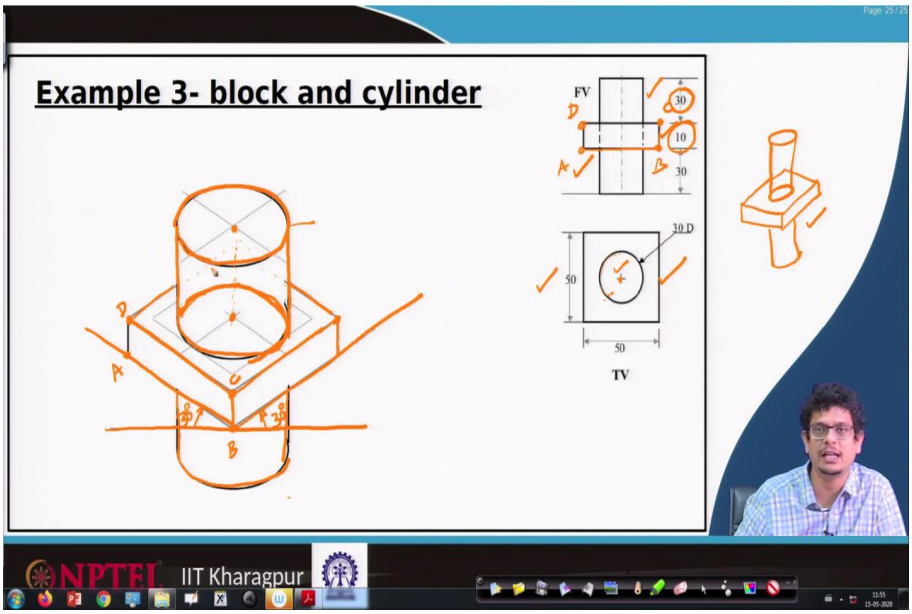

Now, let us take another example. Here we have a block and cylinders, something like a cylinder and there is a block, that block we can see it in the top view it is something like a rectangular block, there is a circle. First of all, get more or less the intuitive idea, looks like a thick block though it is not isometric view what we are drawing, just for imaginative purpose there is something like a box is there.

And because it is having a circular kind of thing extending all the way shaft. So, there must be something like a circular thing, supposed to come out in that way. Now this kind of intuitive way of drawing is very helpful, once that is done we will be in a position to construct 30 degrees lines and go ahead and in a very systematic way, we will construct this isometric views.

So, we would like to begin this one, from the front view if I would like to begin, then there is a length of A B units. So, begin with a horizontal line, somewhere draw a 30 degrees line another 30 degrees line, now A B length transfer it.

Now, from B drop a perpendicular, up to a unit of 10. So, call this one C than from C, D goes parallel to our A B line, transfer C to D length, which is 50 units here. Once that is done, we can convert this rectangle which 50 dimensions, again we have. So, here drop one more perpendicular and because it is a sketch what we are trying to have, first of all, construct that rhombus.

Once that is done, with respect to the centre we have this circle. In the last class, we have learnt how to transform this circle in one view into an ellipse in an isometric way. So, similarly, first of all, we have to construct that circle into ellipse so that, we will be having this ellipse on that rectangular block.

Once it is done, tangent to that we have to construct this vertical cylinder lines. From top view this circle in the isometric view when we are looking at 30 degrees, again that will be a parallel ellipse one has to construct at a height is 30.

So, once we construct this ellipse what we have to do is, we know the centre of that initial circle from there we go ahead by 30 units up, again construct one more transform circle into this elliptical thing. Once that is done draw join these lines because hidden line should not be visible in the case of isometric things, we remove those hidden lines. One more thing for these isometric views, if it is something like coming from the circle and ellipse kind of thing we show that axis. Otherwise, anything at the backside we do not show it by hidden lines.

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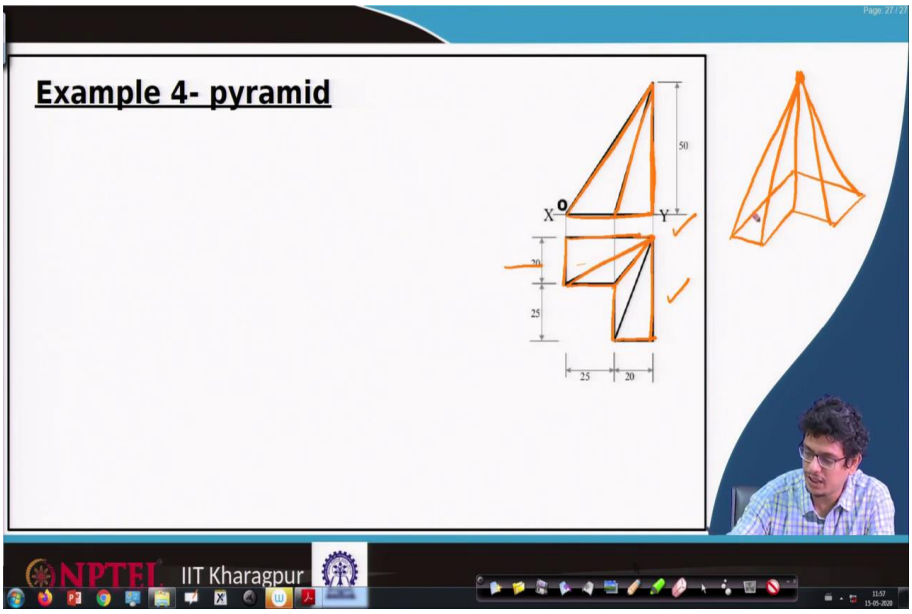

Now, let us look at the last example pyramid. So, first of all carefully visualize these views, the front view and the top view.

It looks like in the top view, we can see that the object has such kind of shape. In the front view, we have such kind of triangular shape. So, by carefully observing these views we can imagine that may be the block the basement might look like that and because this inclination thing and because of this, it might be something like it goes in that way where the views tell us something like a flat base is there. So, maybe it looks like that. Because all these things are coinciding at this point. Similarly, here it looks like this is the way the object might look like.

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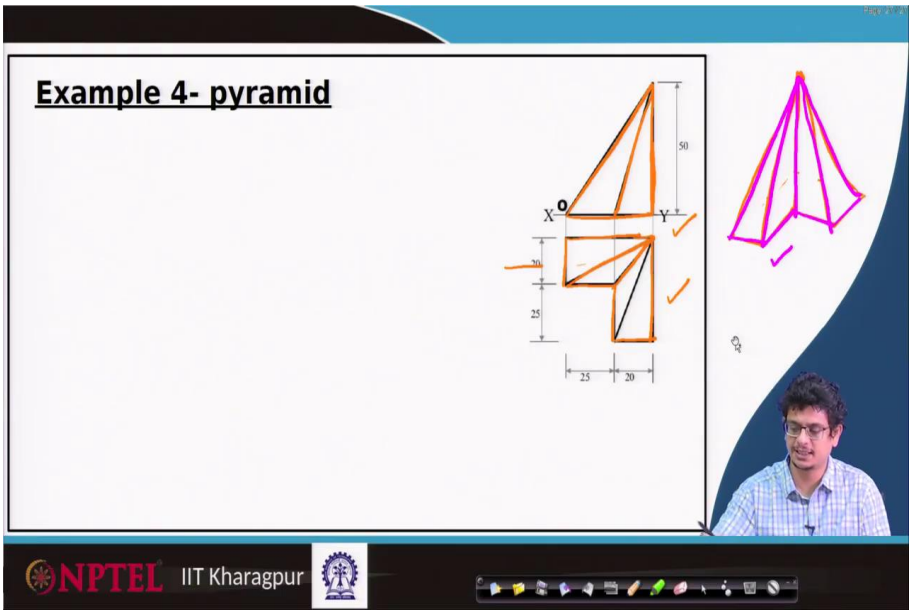

So, if I am removing that, perhaps the object looks like this; so, as a three-dimensional thing. Once we have that kind of view visualization we can go ahead and systematically construct such pyramid.

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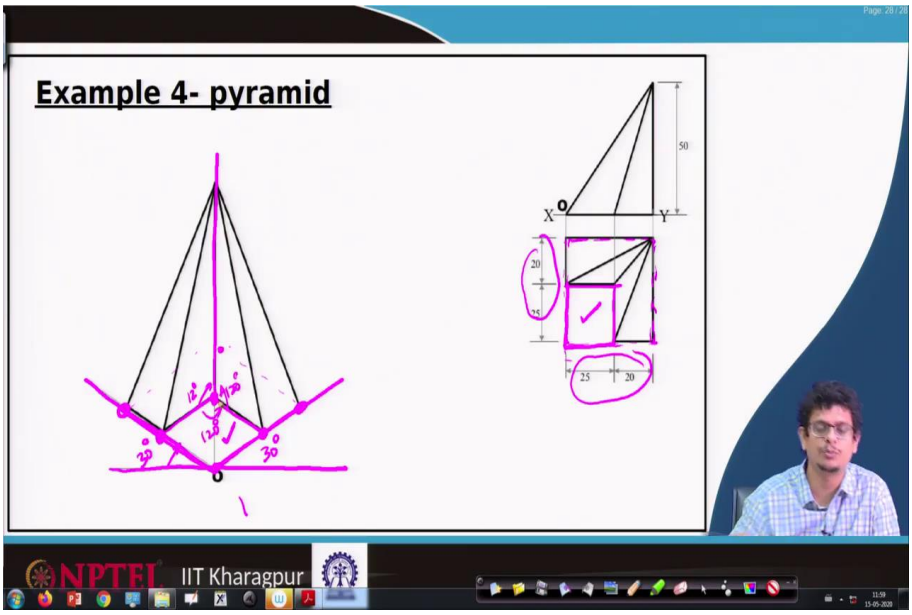

So, the first step what we have to do is, as usual, a horizontal line drawn 30 degrees lines, that coincides by bringing this box into the system. This is the rectangular box, what we would like to change it into isometric views. So, whatever 45 units we have here 45 units there, so 45 units and construct the basement rectangle.

Once done, transfer this small rectangle also, which is not there. So, transfer that rectangle so that we will be in a position to identify these points. Once we have this, square into a rhombus kind of shape we have this edge from H drop a perpendicular line.

So, you can see here the 120 degrees, 120 degrees and 120 degrees which serves as principal axis of the system.

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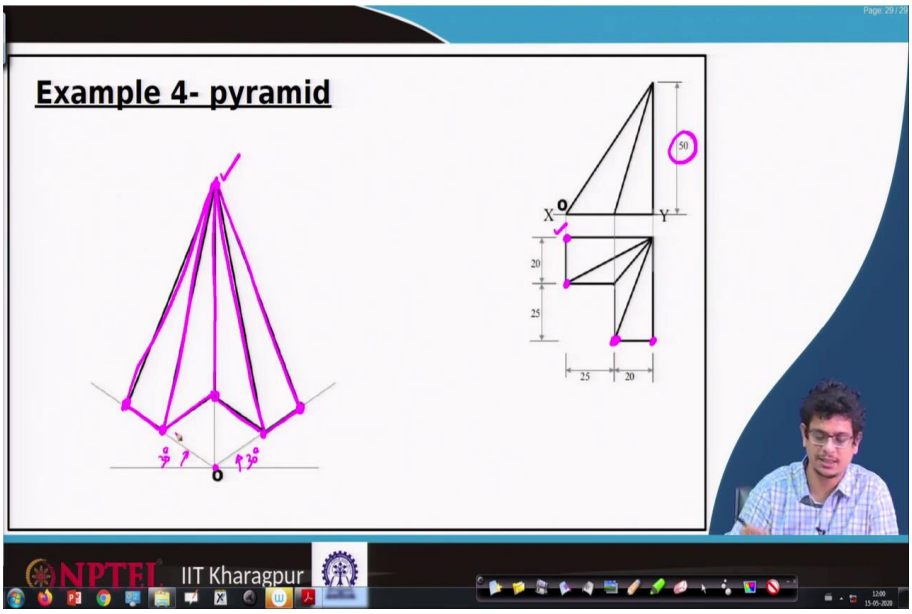

So, once we transfer that 50 units are the length, so that is from the base. So, base, once we have defined, along that line up to 50 marks, point the peak. Similarly, we have to transfer this 20 units on the rectangle, with respect to this point 20 units; that means, this is the point with respect to that 20 units first locate it.

Similarly, with respect to that point, this point is at 20 units location. So, with respect to that point, twenty units locate it. Once done, join these by lines. This is the way we keep and typically just to mention this axis labels, we are just leaving this 30 degrees lines as it is.

So, with that, we will conclude our isometric projections and in the next class onwards we will learn about computer graphics. More details of this iso isometric projections, we can learn from the book Engineering Drawing by Professor Dhananjay Jolhe.

Thank you very much.