Engineering Drawing and Computer Graphics
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Module – 06
Lecture – 49
Isometric Projections (Contd.)

Hello, everyone. Welcome to our NPTEL online certification courses on Engineering Drawing and Computer Graphics. We are covering Isometric Projections and we are in module number 6.

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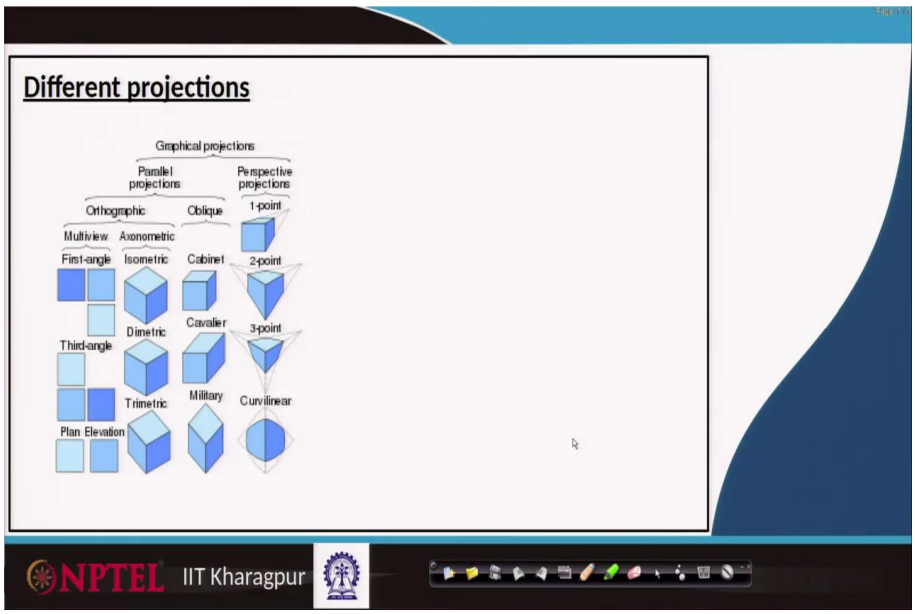

So, in the last class, we have seen a different kind of projection techniques namely the parallel projections and perspective projections.

In that we noted down orthographic projections, oblique projections and perspective projections where we went with axonometric projections which are part of orthographic projections; in that try to learn about isometric projections, dimetric and trimetric.

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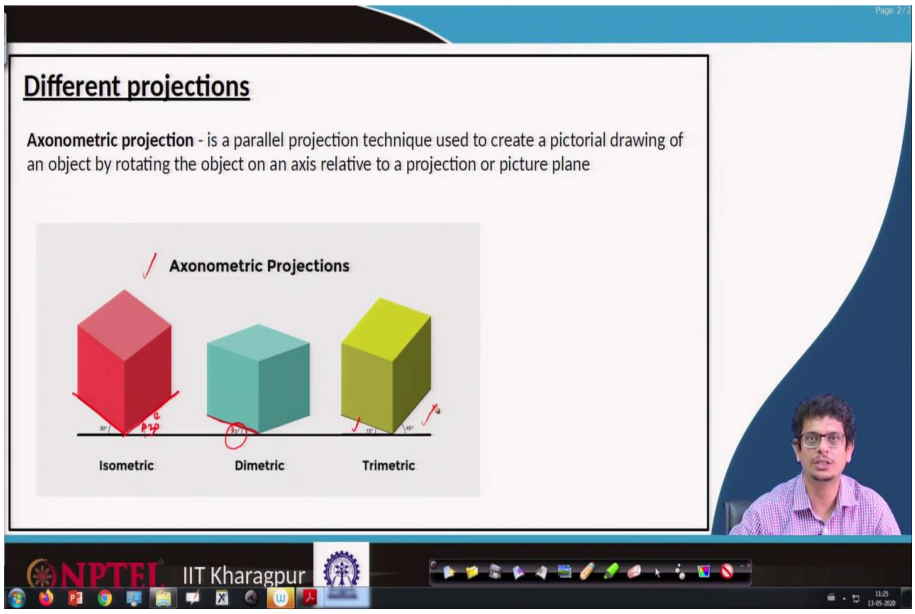

Then we try to understand what is an isometric projection, a dimetric projection, and trimetric projection in terms of the inclination angles. On both sides, if it is equal and making 30 degrees with the horizontal and the entire object we orient in such a way that a cuboid looks like a hexagon such kind of projection what we call isometric projection. In dimetric projections, we have different angles something like lower than that 30 degrees, here it is 15 degrees.

And, in trimetric we will have different three angles and something like less than 30 degrees and more than 30 degrees, such kind of projections we call trimetric projections.

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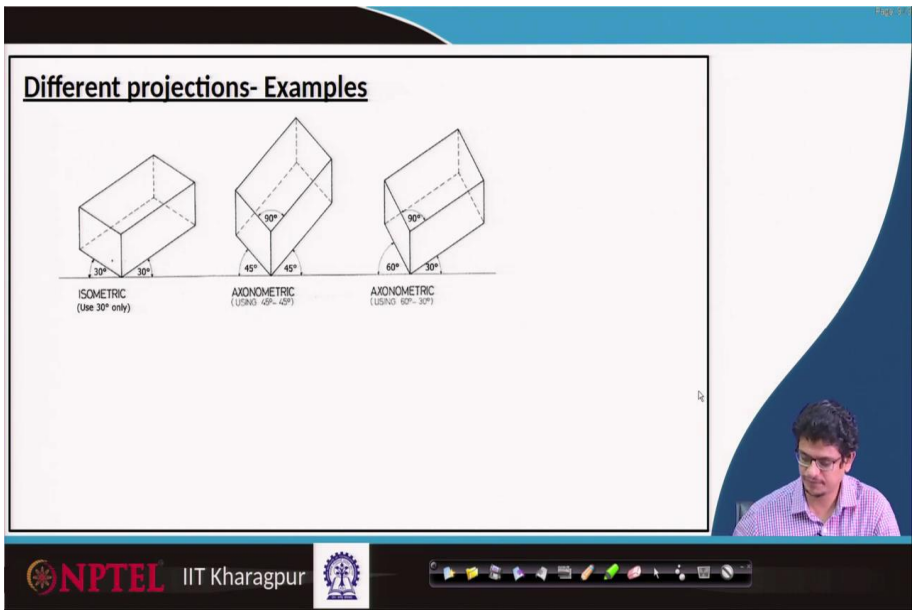

If a rectangular box is given to draw these isometric projections in today's class we are going to learn step by step how to do those especially a rectangle if it is lying on the particular plane how it can be visualized through isometric projections.

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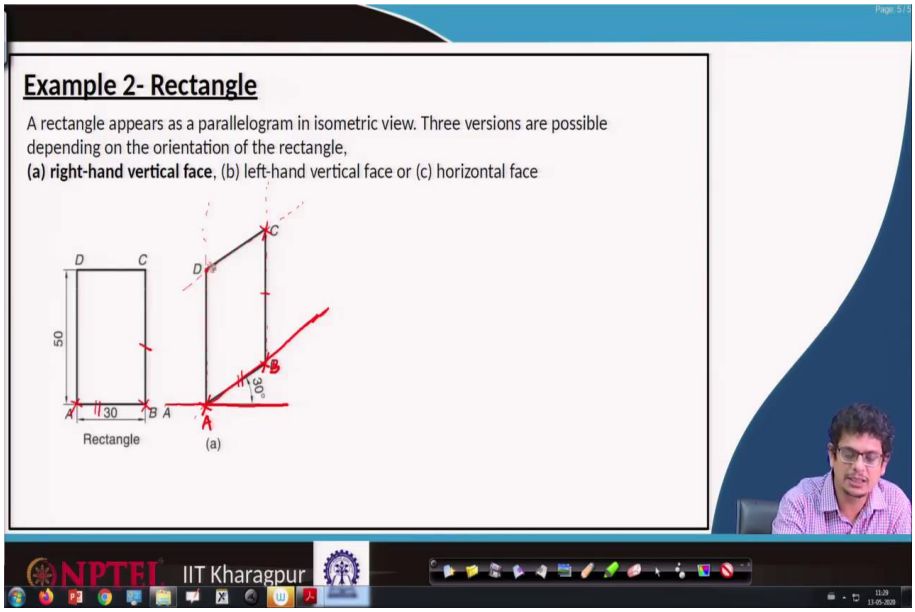

So, let us take an example of a rectangle. Now, we have a rectangle of size 30 mm in width and 50 mm in length. Let us name the corner points as A, B, C, and D. Now, we would like to have projections for this rectangle.

The first one what we are trying to say there are three different kinds of projections possible - one we call right-hand vertical face is an isometric projection, the left-hand vertical face that is also isometric projections and the top view of that horizontal face. Now, let us look at these projections step by step. In isometric projections first of all we have to construct this isometric axis where lengths can be measured on a true scale basis.

So, to do that, we are going to, first of all, learn this right-hand vertical face. For example, if I have a rectangle and I would like to view it from a slightly inclined right direction the way how that rectangle looks like that is what we call right-hand vertical face thing. So, something like you has a hand, slightly turn to observe it from the right-hand side how it looks like.

So, to do that what we have to do is first construct a horizontal line and draw a 30 degrees line because for isometric projections 30 degrees line is inclination line is very important. Now, whatever the length AB, the same length mark it as A and B on this isometric plane construction. So, call this one

A B because we are drawing it on isometric axis true lengths we will see. So, whatever AB and this AB, the same.

Now, from A drop a perpendicular up; similarly, drop a perpendicular from B to C. Parallel to AB line with a distance of B to C whatever the distance BC there and another BC located. So, draw a vertical line, on that, construct whatever BC length we have it on this rectangle even on the isometric view use the same length.

Then use your drafter parallel to this red line, draw one more line passing through that point C wherever this perpendicular A line means this horizontal line call it D. So, now, we have points ABCD and this is the first isometric view because we are observing it from the right-hand vertical face.

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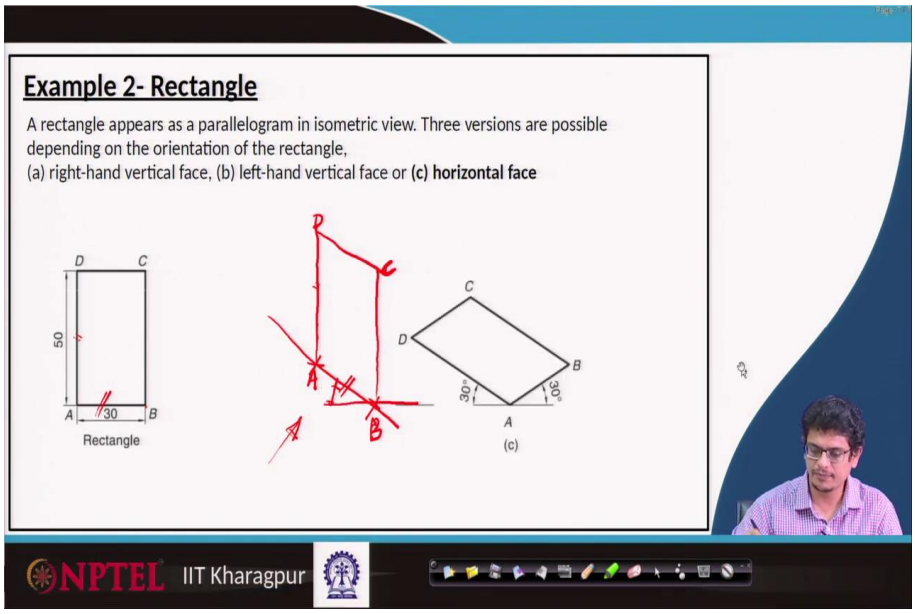

Similarly, let us construct a left-hand vertical face. For that the same procedure we will follow first we will draw a horizontal line, then draw an inclined line with respect to B we are rotating it. So, name these variables A I am sorry this is supposed to be A, this is B, this is C and this is D. Draw a 30 degrees line whatever the AB distance we have the same AB distance we are going to have it.

Mark AB, drop A perpendicular line name it C; similarly, drop a perpendicular line whatever AD length is there, we have the same AD length. Draw a parallel line to AB line connect it. This is the way we construct an isometric view in the left-hand vertical face. If it is a top view of the horizontal face what we are going to do.

Draw a horizontal line draw an inclined line 30 degrees, another incline line 30 degrees. Whatever the AB length is there, locate the same AB length whatever the AD length look at the same AD length

drop perpendiculars from B and CD. So, from the top view, we will construct an isometric view in that way.

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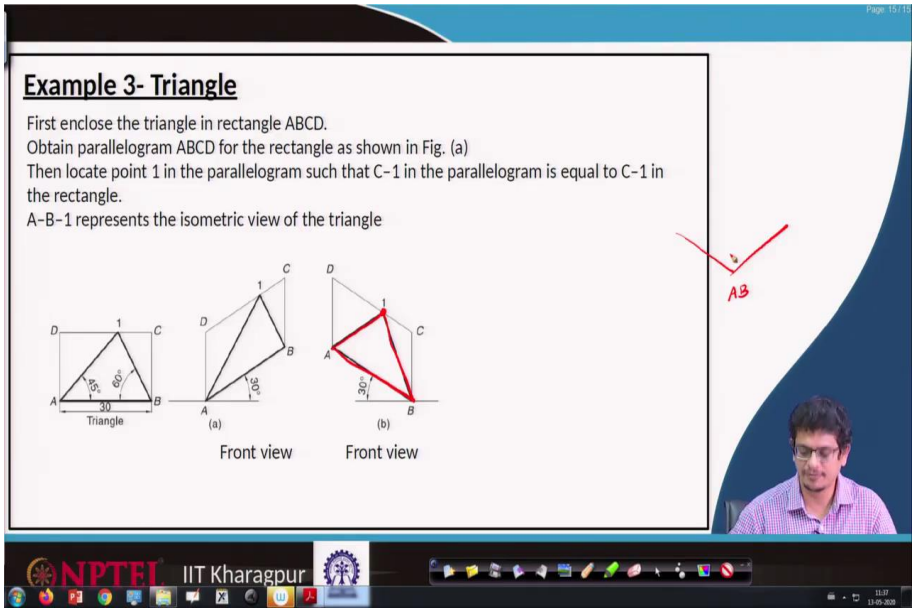

Now, let us look at how to construct a triangle and what are those isometric projections. The triangle is AB perhaps someone is given with certain inclination angles. It has a base of 30 units and one of the angles is 45 degrees on this side, another angle is 60 degrees. This triangle we would like to rotate it in such a way that isometric view we can visualize it with base 30 degrees.

The first step for any of these kinds of objects enclose these objects in rectangle if you are knowing how to draw a rectangle, similarly, we measure the other points and align with that rectangle and rotate it that is the easiest way which we popularly call as box method. So, first for the rectangle draw ABCD lines enclose this triangle in this rectangle. Now, this entire rectangle has to be rotated as a parallelogram with that 30 degrees line. So, the way how we have constructed rectangle AB, draw a 30 degrees line on that locate AB points for the right face now from B perpendicular line. So, B also perpendicular line; from A also perpendicular line and parallel to AB, draw at a distance of BC this rectangle.

So, we know how to construct that rectangle construct that. So, the steps what we have followed AB, AD lines then BC lines and then CD lines we construct it. Now, for the triangle from point 1, we have to locate it on the rectangle further what is the distance from C to 1 on that rectangle. Pick that distance, similarly on CD line locate C 1.

So, use your compass or divider whatever that length transfer that length to here, then call that point as 1. Once we know 1 point and AB points are known we can join them. This is the way isometric view we can construct it. Similarly, if we would like to have the left-sided front view in the isometric planes first draw a horizontal line. A point we are rotating in that direction. So, draw a line 30 degrees transfer AB length here. Construct the remaining rectangle BC lines vertical, AD lines also vertical, draw them. Transfer 1 to C length here; one can transfer D 1 length also in the same way, the way how we transfer D 1 we can transfer it there all 1 C length we can transfer it.

Once done we have this point 1, now join A 1 B to construct the triangle. Now, we would like to have it in top view on how to construct that. So, one of the axis we need an isometric theme. So, that means, use AB line as one of the isometric axes on that we can construct it; for the top view, we require one more isometric axis also. For that purpose use AD lines.

So, AB and AD we are rotating in such a way that they are going to make equal angles.

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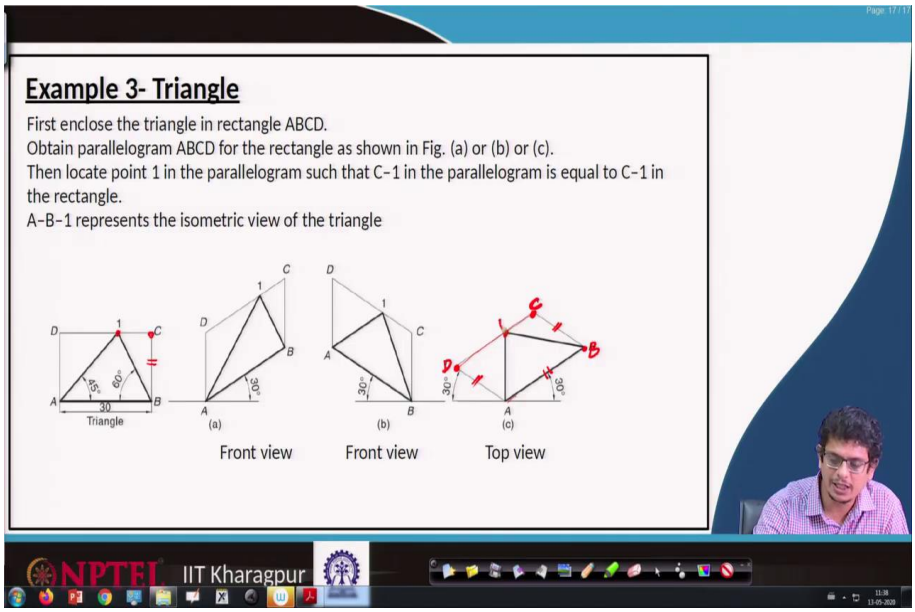

So, let us look at that. First, we draw a 30 degrees line. Similarly, draw one more 30 degrees line name it a transfer AD length; similarly, transfer AB length on this planes. Once we transfer that we know these points B and D.

Now, parallel to AB line draw one more line at a distance of BC. So, we have point C. Now, transfer 1 to C length from C to 1 here. Once it is done connect point A, B and 1 in the top view we have that isometric projection.

So, all about this isometric projection is if you have an object if you are rotating in such a way that it makes equal angles on both the planes that are the way we have to construct this isometric projection. It can be any complicated object, but first, we have to enclose that in a rectangle, rotate that rectangle one of the isometric axis ones has to identify with 30 degrees then transfer the true lengths of this rectangle onto this with the perpendicular lines and parallel kind of lines and locate the points which we will like to transfer it.

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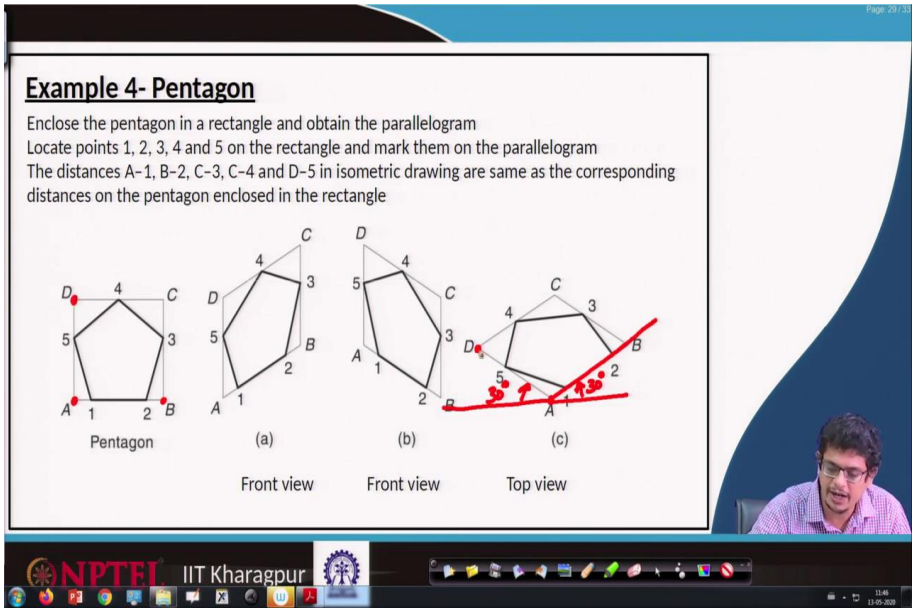

So, the points of the pentagon 1 2 3 4 and 5 we have to transfer that onto this parallelogram ABCD parallelogram. For example, whatever line A 1, same A 1 line we will mark it, so that first point will be done. Then whatever B 2 length is there or A to 2 lengths the same length we use it from A to 1 2.

Similarly, first, we locate A 1, A 2, length then B to 3 whatever the B 3 length we have same B 3 we will locate it; from C 4 C to 4 same lengths we will locate it. Then A 5 we will locate it once we are done we have these points joined by lines.

Now, the other front view from the right side view left side view if we are looking at rotating AB with 30 degrees inclination line from the horizontal. Once we are done with that we can locate 1st point, 2nd point, 3rd, 4th, 5th points by transferring appropriate lengths in that way.

For the top view, the rectangle has to make 30 degrees equal angles on both sides. So, we rotate in such a way that AB lines this makes 30 degrees and similarly, AD line also makes 30 degrees. So, we locate whatever the AD length same AD length here we will locate it; similarly, AB length we will locate.

Once that is done we can construct this rectangle, then transfer lengths A 1, B 2, B 3, C 4 and D 5 lengths appropriately. So, that we will have 1st, 2nd, 3rd, 4th, 5th points join them to get the pentagon in the top view.

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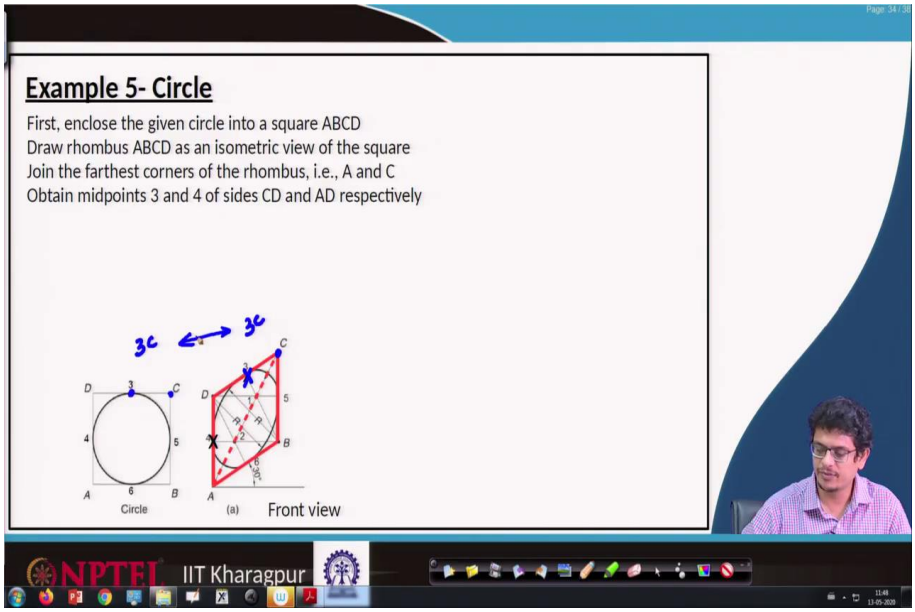

How to do that for a circle let us learn that. The first step is always to enclose a circle in a rectangle. Now, wherever these intersections are there with the circle name them as 3, 4, 5 points for the circle. Now, construct the parallelogram or the rhombus on the frontal view we have seen how to construct this AB line with a 30 degrees transfer remaining CD lines also so that we have this ABCD rectangle.

Now, obtain the midpoints 3 and 4 of the size CD and AD. So, CD the point is 3. From DA the point is 4. These points have to be transferred on to this rhombus. For that purpose, the way how we do is, measure what is the distance of C to 3 on this rectangle because we have already identified C, now use your compass dividers to mark three points where 3C here and 3C there are equal to each other on this rhombus.

Similarly, D 4 or A 4 distance locate it from A to 4 marks that point as 4 and 3.

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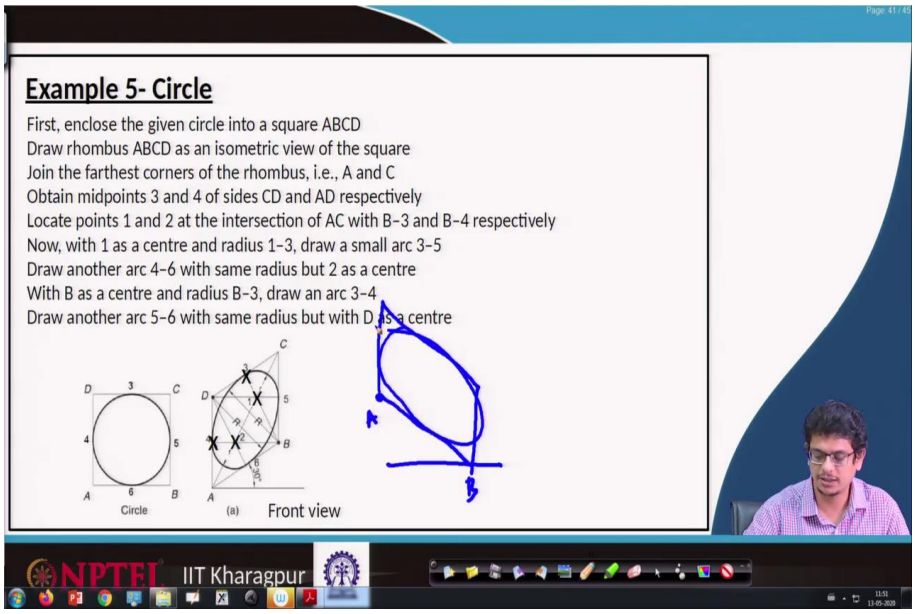

Once that is done join B to C by a line similarly join B 2 4 by a line and join A to C the diagonal line wherever this intersection is happening call that point as 2 and 1. I repeat, so, join B to that fourth point similarly join B to the third point wherever it is going to intersect the diagonal call those points 1 and 2. Use 1 and 2 as centres. So, using those 1 and 2 as centres measure what is the length 1 3, then draw an arc all the way passing through there. 1 as the centre, 1 3 as radius, draw a smooth arc which is intersecting point 5. The way how we have located B to connect 3 and 4, a similar way one can even construct from D to that end and to this end to track 5 points 5 and 6 points.

So, once we know that circle arc draw that one; similarly, using 2 as centre draw another arc passing through 6. Now, join 4 to 3, similarly 6 to 5 by a smooth curve. So, your circle converts into an ellipse in the isometric view.

Similarly, if we want left side view we repeat the same process construct that parallelogram, making horizon 30 degrees line. In this way locate AB points transfer our rectangle and construct the remaining ellipse.

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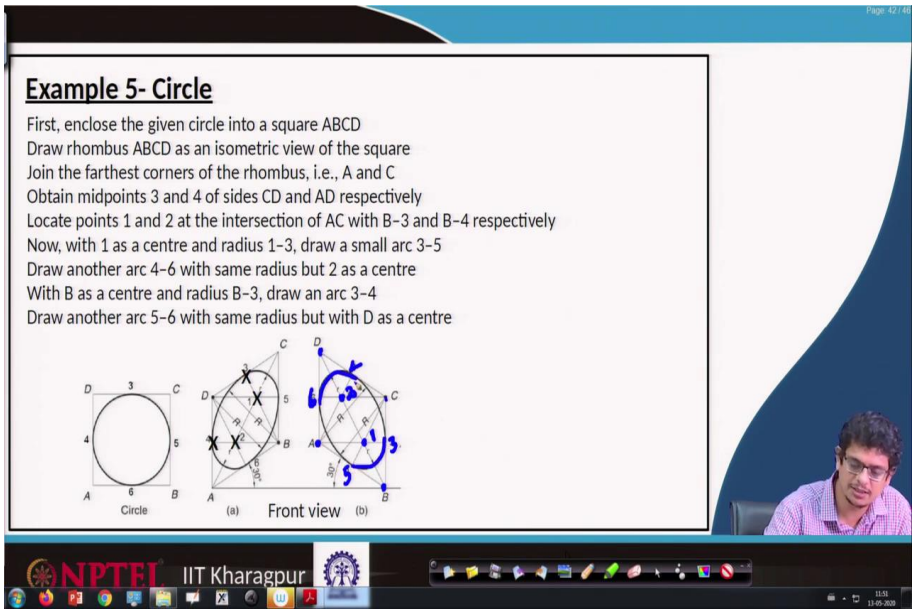

So, let us look at that solution. So, construct AB CD transfer these data points 3-4 and 5-6 locate centres 2 and 1, use radius, join them as circles through arcs.

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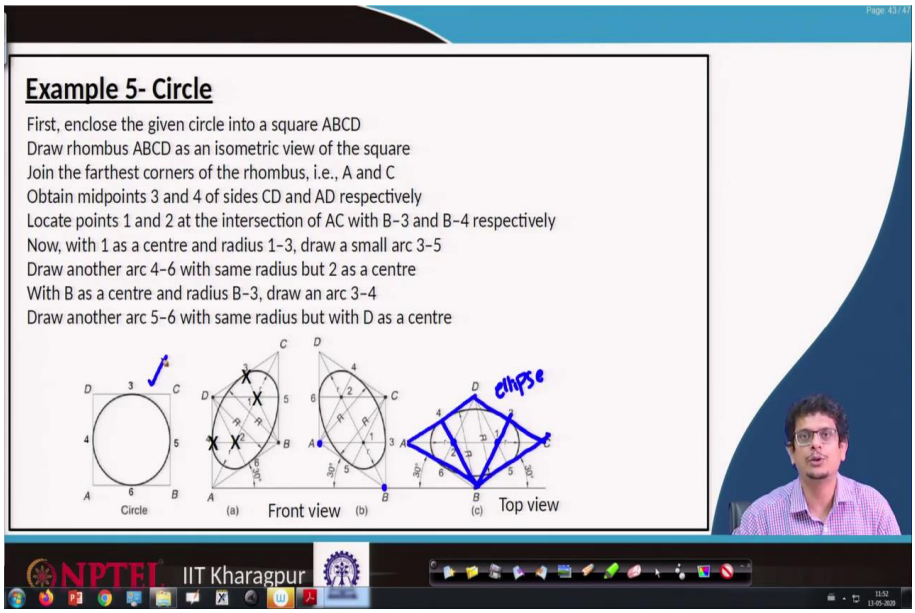

For top view the same procedure AB line makes 30 degrees, BC line makes 30 degrees construct the parallelogram; then from B to this third point, similarly B, all the way to the fourth point by transferring 3 and 4 points from this rectangle. Construct these instantaneous centres 1-2 and then draw the arcs connect by smooth arcs to get this ellipse. So, in isometric views your circle when you rotate it, it looks like an ellipse. And, in the next class, we will learn about how to do these isometric projections for solid objects. Thank you.