Engineering Drawing and Computer Graphics
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Module – 04
Lecture – 38
Orthographic Projections II (Part -8) – Projection of planes

Hello all, welcome to our NPTEL online certification courses on Engineering Drawing and Computer Graphics. We are covering Module number 4, Lecture number 38, it is about Orthographic Projections especially Projection of planes. If two-dimensional objects are present how to visualize these views.

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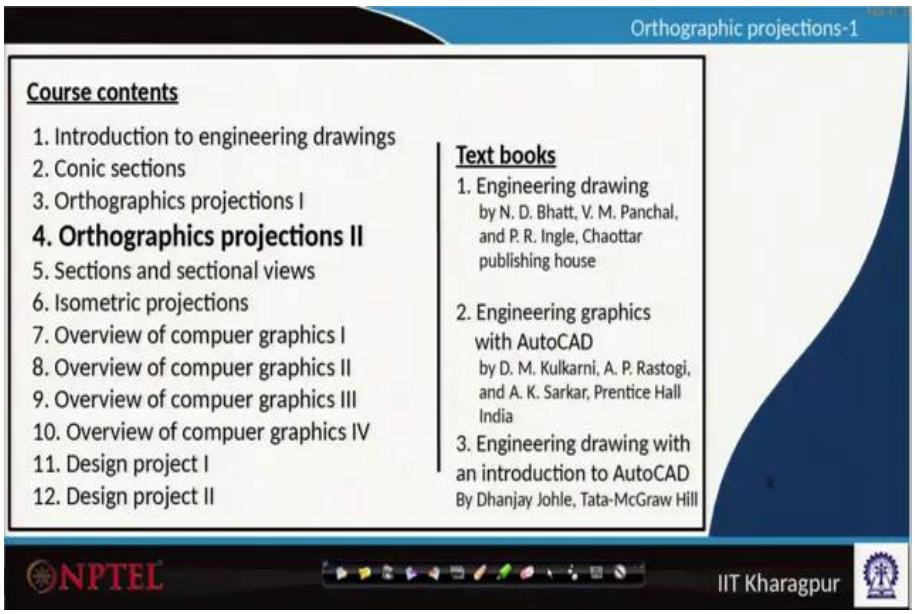

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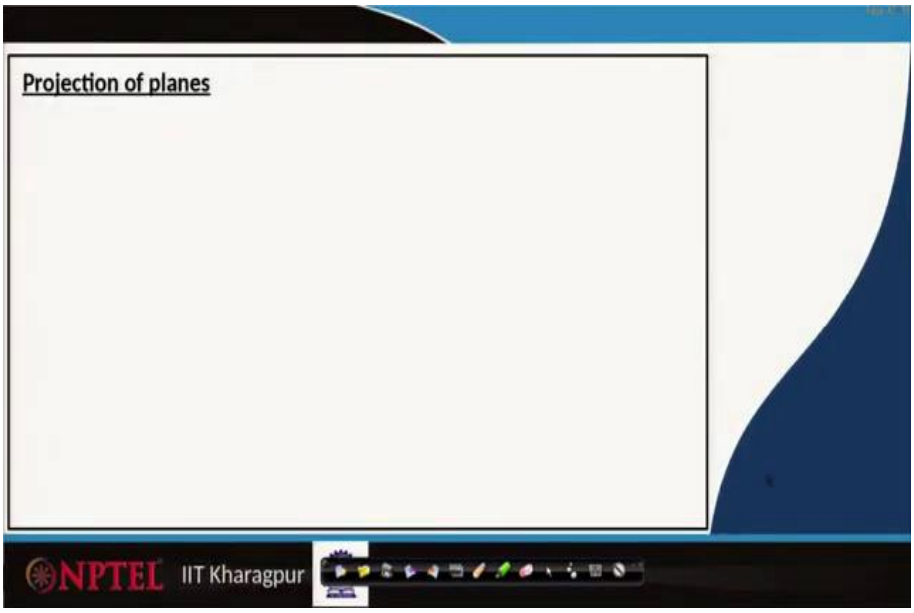

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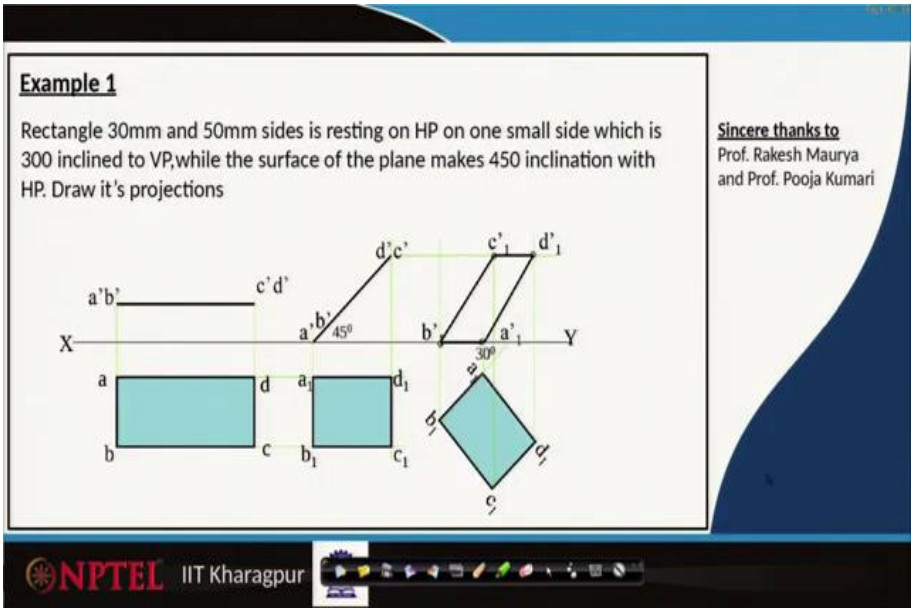

So, in the last classes, we try to look at the projection of planes, especially if there is a rectangle and that rectangle if it is reoriented with the X-axis, Y-axis in a specialized way, how to construct these views.

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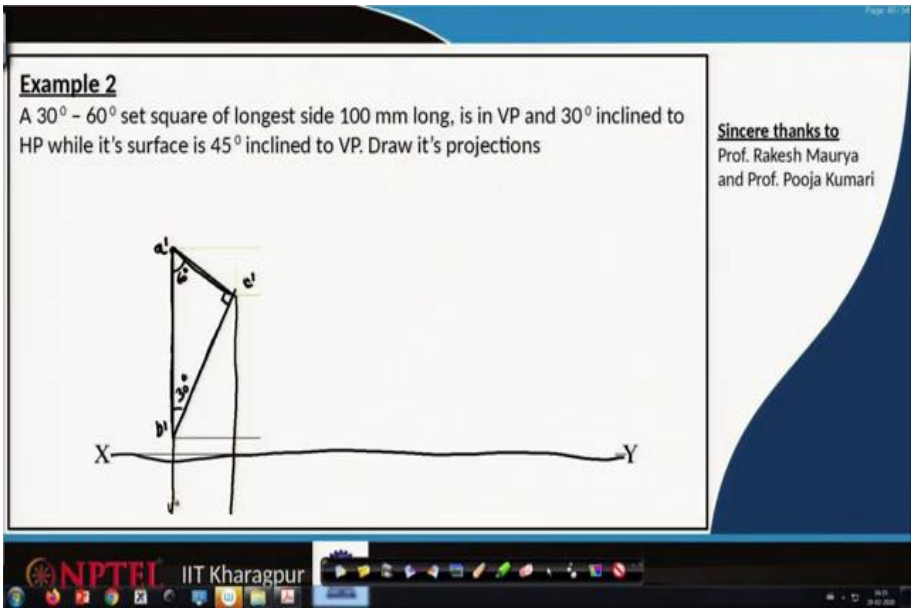

In today's class we will learn more about triangles, for example, a set square if it is reoriented with horizontal planes and vertical planes, how do they look like? For example, if we are having 30 degrees-60 degrees set square. So, this is the combination. So, one of the angles is 90 degrees, the other one is 30 degrees, the other one is 60 degrees, the long set square what usually we go with.

This set square is a two-dimensional object for our simplification and perhaps let us assume that the longest side having 100 mm length, if it is having 100 mm length 10 centimetres and it is in the vertical plane the longest side and 30 degrees is inclined to the horizontal plane while its surface is 45 degrees inclined to the vertical plane. Draw its projections.

For example, this is the one longest set square what we can have and this longest one on the vertical plane it is in the vertical plane. So, vertical plane if we are considering, if we are considering this one the longest side is in the vertical plane in this way and the second thing is, it is 30 degrees inclined to the horizontal plane. So, the horizontal plane is in this perpendicular direction. So, what we have to do is either in this direction 30 degrees or perhaps in this in this way 30 degrees we have to align.

So, the vertical plane is this the longest one, the longest one is on the vertical plane in and the longest one is making some 30 degrees angle with the horizontal plane. So, if I am

projecting that onto horizontal plane there is a 30 degrees thing. And this entire surface after that; this entire surface right now perpendicular to the vertical plane, but now if we are making something like in this direction 45 degrees, how does that look like in the projected planes like normal planes top side planes. So, that is the thing what we are trying to construct it.

Let us look at it step by step, in that case, first of all, we have to realign this entire set square into right perpendicular planes so that we will be in a position to draw it. The problem statement is this entire vertical one on the vertical plane and it makes 30 degrees angle and then it is flipped by 45 if that is the case, we have to reverse this entire problem first flip it by 45 degrees and then turn it back 30 degrees from there begins the journey construct the remaining views.

So, for that purpose what we are trying to do is draw an X Y line, in the vertical plane the entire set square the longest one lying. So, we first construct that one, this is 90 degrees angle, this one 60 degrees and this one 30 degrees and locate the points in the frontal plane a', b' and c' this always have projections downwards and this point also downwards.

If we are looking from the top view of this, this is the frontal plane from top view it looks like a very thin strip, where a b coincides to a and b points. Similarly, this c point c' whatever we are looking in the front view projected to c. So, the actual length what we are going to see is this projected length, that is we are going to see it in a top view. Now, this has to be rotated.

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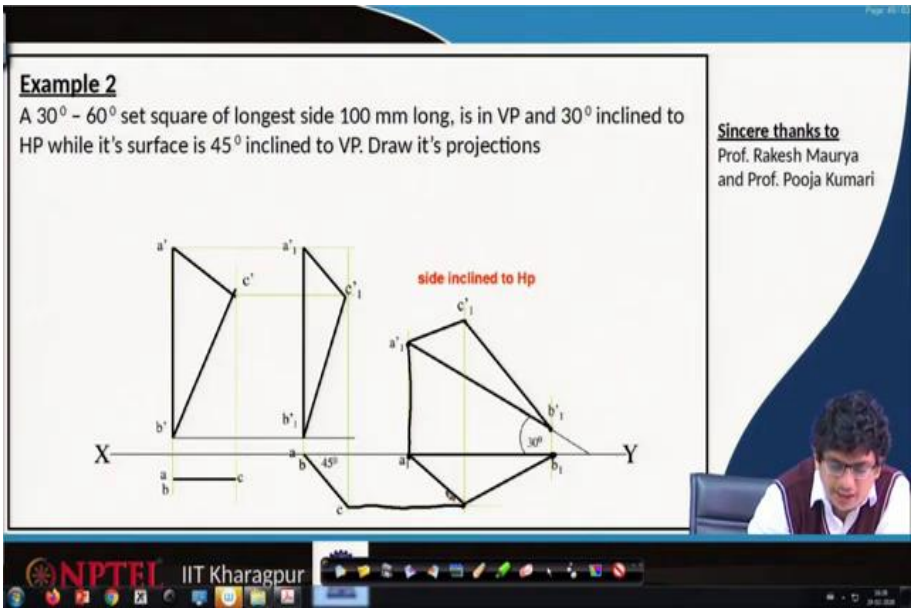

So, this is the, from frontal view this plane. This a c when we are looking at that direction that entire surface has to be flipped in 45 angles here, we can see that the surface is 45 degrees inclined to VP.

If that is the case any inclination with respect to the vertical plane, we can perceive it only or observe it only in the horizontal plane. In that case, this a b line for the same line we make it 45 degrees angle with the horizontal plane draw it as a top view. In the top view, we can observe this inclination angle with the vertical plane, so that a point, b point and c point we can draw it.

Now, reproject this entire a b lines and c line and similarly re-project this entire c points a points and b points. If we do that the intersection points from b' intersection from b intersection this one, from an intersection and a' intersection gives me one more point there, similarly c projection all the way there, and c' projection to that. So, now, call these points as a 1', b 1' and c 1', this is the first projection or rotation what we made with the vertical plane.

After that, because two rotations we have to do; one is first aligning this entire vertical one, then rotating it by 30 degrees then flipping it by 45 degrees. If we want to reverse it first, we have to flip that 45 degrees which we have already done then we have to turn it by 30 degrees, that is the way we have to proceed.

Now, already this longest one we have constructed, this entire thing has to be rotated by 30 degrees. So, a 1', a 1, a 1, b 1, b 1' so, this length whatever from this point to this point that length the same length we are going to keep it here.

However, this has to be turned around by 60 degrees otherwise a 1', b 1' has to make 30 degrees up to that we will rotate this object, when we rotate that object this a 1 point map to that, b 1 point map to that, c 1 point a 1 to c 1 whatever the arc b 1' to c 1' whatever the arc can construct this c 1'. This is the way we re rotate that object.

So, now, the last step projects this entire a 1 down, because this set square supposed to be on a vertical plane so, the longest one always being touch with this vertical plane.

So, a 1' meeting this x-axis, b 1' meeting at this point, project this c 1' down because it is supposed to make 45 degrees with VP. So, that projection determines our c 1. So, we will have this c 1 point, b 1 point and c 1 point this is the way we make these rotations for these objects. Let us construct that on our sheet.

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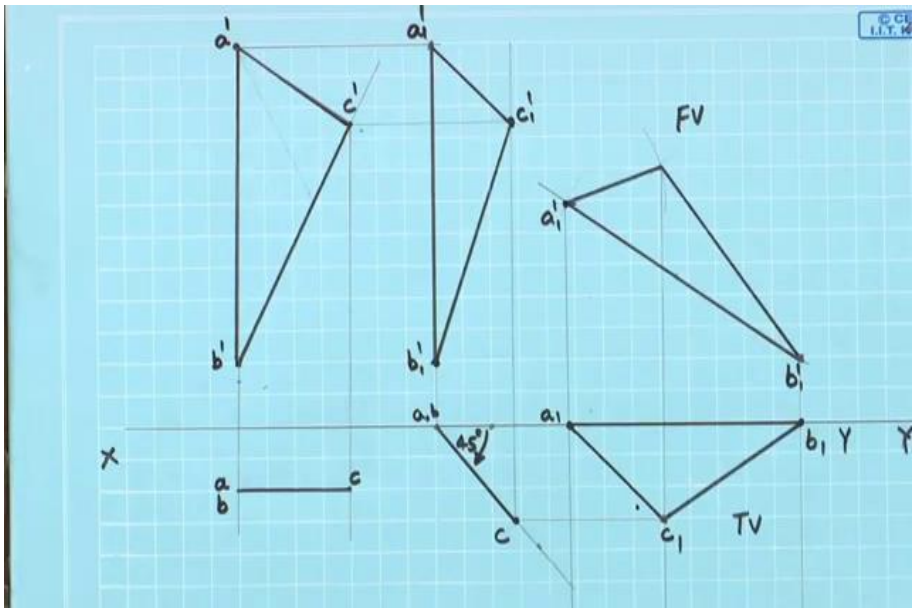

First of all, on the drawing sheet construct a horizontal line X Y axis, this is the X Y axis, in that axis 100 mm long we have to use the first one. So, let us leave a gap to begin from top 100 mm somewhere there, this is one 1 2 3 4 5 6 7 8 9 and 10 here construct that, name this point a' in the vertical plane b' and we know one angle supposed to make 30 degrees other one is 60 degrees.

So, let us construct the angle 30 degrees thing so join this. The other angle supposed to make 30 degrees. So, 30 degrees means here now join these points. The other one is making 60 degrees. So, we made a mistake here it is not an equilateral triangle. So, you supposed to make 60 degrees somewhere there so join these lines.

So, our triangle now let us call c' if we are projecting up in the this will be the length of our projection in the top view. So, let us call this is a, b point also map there, c point also maps there. Now on the same X Y plane, we want to touch this a b line which is making 45 degrees angle. So, what we can do is on the axis itself we can construct it at 45 degrees this a b has to touch.

So, if that is the case pick a point here somewhere from there. So, from this point let us call a, b point it is supposed to make 45 degrees when it is in the vertical plane join these points, transfer the same length a to c this length has to be transferred and connect these lines and this is making 45 degrees angle and this point is c. Now, transfer all these points the projection, similarly, this c point also projected there.

Now, we can project this c point and a point. So, c point cuts c axis and a point cuts that axis there. So, this will be thse a point. So, now, in new notation this is a 1', this is c 1' and this point which is projected, so this is what we call locus and this is the projection. So, the locus point is here b 1' now let us join these points. Now this entire object a 1 c, a 1 b has to be made into 30 degrees angle.

So, what we will do is, from here we will make a 30-degree angle let us consider the point extreme point which is projected onto this line. So, let us assume this is the point from that point we will make it 30 degrees. So, 30 degrees line is this let us join it in that a 1', b 1' whatever this length we have this one that one has to be mapped.

So, our b 1 point is, a 1 point here, c 1 point will be the same by transferring from here, whatever the radius we have joined this by lines. Now, their projections if we are looking, let us look at their projections a 1 goes there, c 1 goes there, b 1' goes there, we want to keep this on the vertical plane. So, this one maps to b 1 and this point maps to a 1 and this line maps to are the locus if we are constructing from c this point let us call c 1.

If we are joining these lines this is the front view top view of that object, just to summarize for example, if we have this set square this is the one and let us consider the vertical plane

is this object if this is the vertical plane and this is the horizontal plane and this longest one if it is aligned in this way the set square, this set square we are aligning it with the vertical plane in that way.

Initially, when it is 90 degrees you just see it like only a line after that we can make it into a 30-degree angle then the square looks like this and after that, if we are flipping it by 45 degrees it looks in that way. So, front view now it is skewed kind of triangle similarly from top view also it will be a skewed triangle. So, what you are observing is a top view of that set square and that top view here we are seeing and that front view one is seeing there.

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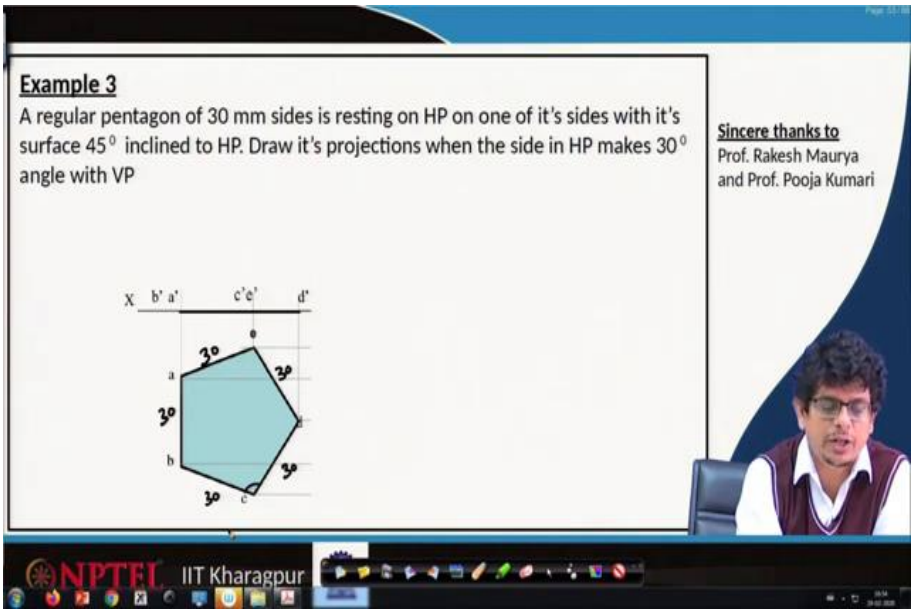

With that, let us move on to the next example. In this next example instead of a triangle, we are looking at a pentagon. So, it is a pentagon of 30 mm side and one of the sides is resting on the horizontal plane, on one of its sides with its surfaces 45 degrees inclined to the horizontal plane. If that is a case draw its projections when this side in HP makes a 30-degree angle with the vertical plane. So, let us look at the solution.

This is the typical pentagon it has 30 mm sides, so this one is 30 mm we know how to construct a pentagon from this inscribing a circle or circumscribing a circle or perhaps the other way like from semi-circle method also we can construct this pentagon. The other way is by knowing the angle between these two sides also we can construct this pentagon.

Now its sides are resting on HP and one of its sides with this surface 45 degrees inclined to HP.

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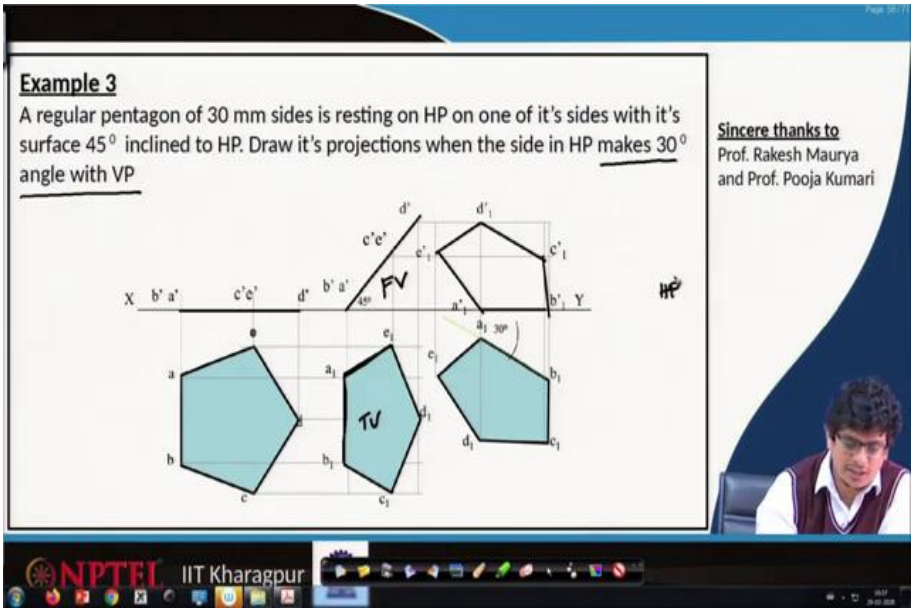

So, one of the sides if it is making 45 degrees in the front view, we will see that 45 degrees. If it is resting on the horizontal plane, we see the hexagon for example, pentagon completely if the pentagon is completely resting on the horizontal plane, we see that entire shape, by rotating it suitably one of the edges we can make it like 45 degrees or 30 degrees, 60 degrees and so on.

So, top view it will be like that if we are looking from front view it will be just a line where b point, c point, d points mapped to this b', c', d' respectively. So, first construct this pentagon, after that project it gets the projected length. Once that projected length is available, we use the same projected length, but with 45 degrees because is making one of its sides with its surfaces 45 degrees inclined to the horizontal plane.

Anything inclined to the horizontal plane we can be in a position to see it in the vertical plane. So, on the vertical plane, we have that 45 degrees after drawing that we project the complete points from a point map there, b point, c point, e point and d point these are mapped to respectively a' points, c', e' points, d', e' points.

So, for example, let us look at a point goes on to this projector line a' also goes on to that projected line, next b one projected to that and b' also projected to there. In that way, we will be in a position to construct this pentagon.

After 45 degrees this rotation where we have constructed this front view and top view now we are going to align one of the sides it can be a e 1 or it can be a 1 b 1 sides also. So, what about that side with a vertical plane if it is making naturally any angle making with the vertical plane, we will see it in the horizontal plane. So, that angle we will align it. So, the side let us consider a 1 b 1 side we are going to pick it, align it with 30 degrees angle from the horizontal plane.

Transfer this length a 1 b 1, a 1 b 1 there. Similarly, a 1 e 1 length transfer it by using the compass, then b 1 c 1 and c 1 d 1 also transferred in the same way. So, we just have to rotate this by 30 degrees. So, remaining sides also rotated by the same amount, once that is done this entire pentagon will be turned into that direction, once that is done again project these lines from e, c, a, b and c and already we have rotated into 45 degrees in the vertical plane. So, that with the horizontal plane the angle whatever it is making that we are observing.

Have those locus points where these a intersect with a call a1', similarly where b1 intersects with b' call b1', similarly c1, d1 by projecting locus points we can get these points, join them we will get this pentagon which is meeting this criterion like 45 degrees inclined to HP and the side making 30 degrees with the vertical plane.

So, in the next class, we will learn more about these sections planes if they are projected onto different things especially if auxiliary planes can be constructed how these views come in that is we will see in the next class.

Thank you.