Engineering Graphics and Design
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Lecture 21
Example: Rotation of Solids

Hello friends, this is Akash Deep, one of the TA in this course named, engineering graphics and design. In week 4, professor Naresh has explained various kinds of solids projection of planes and projection of simple solids. In this session, we will discuss some questions regarding that.

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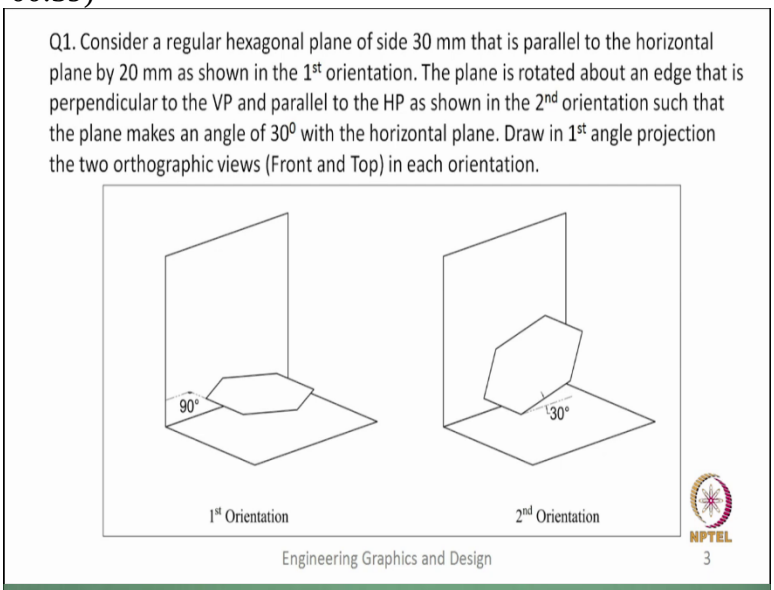

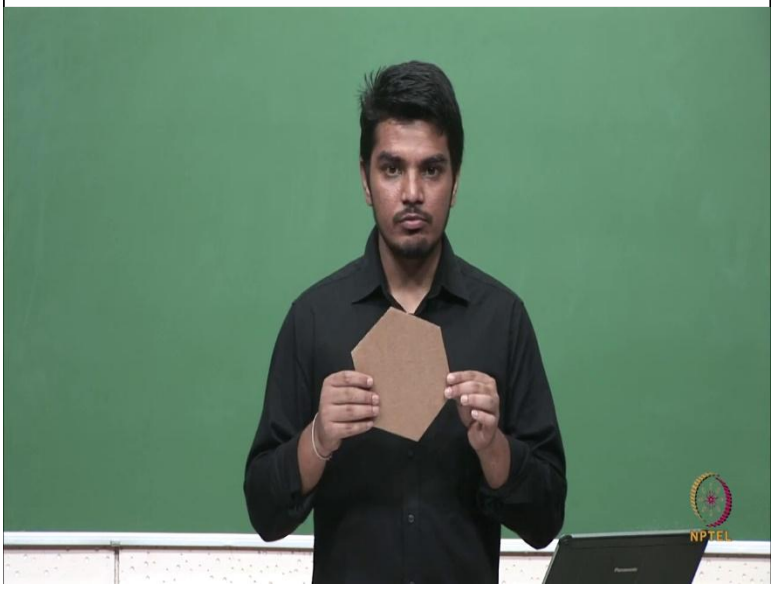

Let us see first question, in which we have a regular hexagonal plane of side 30 mm, which is parallel to the horizontal plane by 20 mm, as shown in first orientation. The plane is rotated about an edge that is perpendicular to the vertical plane and parallel to the horizontal plane, as shown in second orientation. Such that, this plane makes an angle of 30 degrees with the horizontal plane.

And we need to draw the front view and top view for each orientation. So, firstly visualizing the first orientation, we have a regular hexagon with edge length of 30 mm. This hexagon is placed in such a way, that it is 20 mm above the horizontal plane, the hexagon is 20 mm above the horizontal plane. And one of its edge, let us say this edge is perpendicular to the vertical plane. This is the first orientation.

Now, on seeing from top, we can see the true shape of the hexagonal plane. But on seeing from front, only a straight line can be seen. So, now we start drawing it. Firstly, we will start with top view. And using the projection lines of this top view, we will try to replicate the front view.

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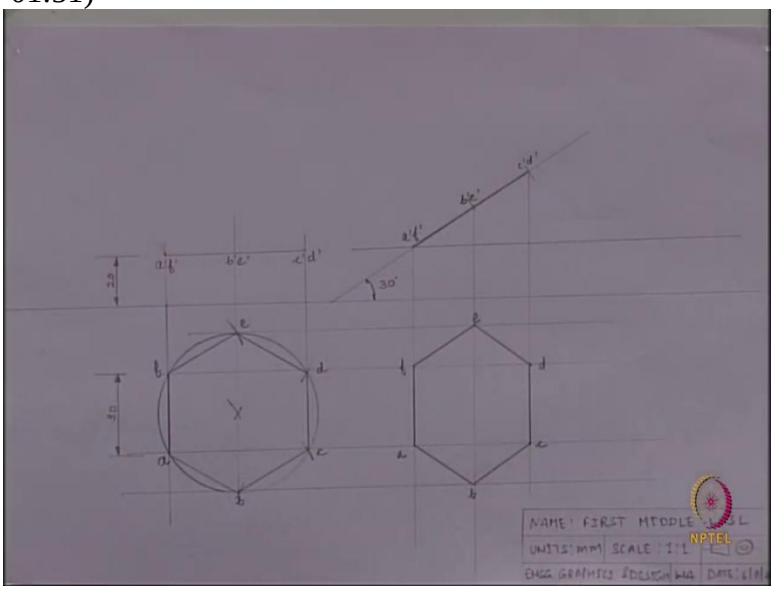

This is the reference line. Since, one of its edge is perpendicular to the vertical plane, so we need to draw a construction line perpendicular to reference. Now, since the hexagon has edge length of 30 mm, so we will start drawing hexagon using the same technique as presented in the class. Firstly, an edge of 30 mm is produced. Now, we would make two arcs of 30 mm each. Now, taking the intersection of these two arcs as a center, we will draw a circle of radius 30 mm.

Now, from the endpoints of this edge, we will draw two arcs of the 30 mm radius. Now, from these two arcs, we will again draw two arcs of the 30 mm radius. On joining these, we will get the regular hexagon. Now, to get the front view, we will use the projection lines. Since, the

hexagonal plane is 20 mm above the horizontal plane, so, the front view will be 20 mm above the reference line.

Now, labeling the front view on top view a, b, c, d, e and f. Similarly, a', f', b', e' , and c', d'. Now, let us dimension it. The edge of the regular hexagon is 30 mm long. Whereas, this hexagonal plane is 20 mm above the horizontal plane. So, in this way, we will get the front view and top view for first orientation. Now, moving to the second orientation, in this, we have this regular hexagon, this hexagon is rotated about this axis to 30-degree angle.

First orientation is this, now, rotating about this axis to 30-degree angle, we get this, this is the second orientation. And for this orientation, on seeing from top, the shape of the hexagon we obtained is not same as that in the first orientation. But on seeing from front, we will get the same straight line of same length, but now it is oriented about 30 degree angle. So, we will start first drawing the front view.

And using the projection of front view, we will draw the top view for the second orientation. We will draw a 30-degree angle from any random point. Since, the length of the front view will remain same, so we will measure this length, and produce an arc here. Similarly, this length. Now, we will join, to get the front view, labeling it. Now, the projection of these points, the front view of these point are here.

The top view must be there, below these points. So, we will draw the projection lines. To draw the top view, we will use the projection lines from the previous orientation. This can be an interesting question, that why we are using the projection from previous plane. This can be explained, like if, if we have this hexagon is, in the first orientation. And now moving to the second orientation, the distance between any of the point in the hexagon and the vertical plane remains same.

I am repeating this, for example,if this is the first orientation and this is the second orientation, if I take a point let us say this point, the distance between this point and the vertical plain will remain same as we move from first orientation to second orientation. That is why we are drawing the projection line parallel to the reference plane. Let us mark the points. And on joining these points, we will get the top view for second orientation. Now, we can mark the angle. So, in this way, we can get the front view and top view for both orientations.

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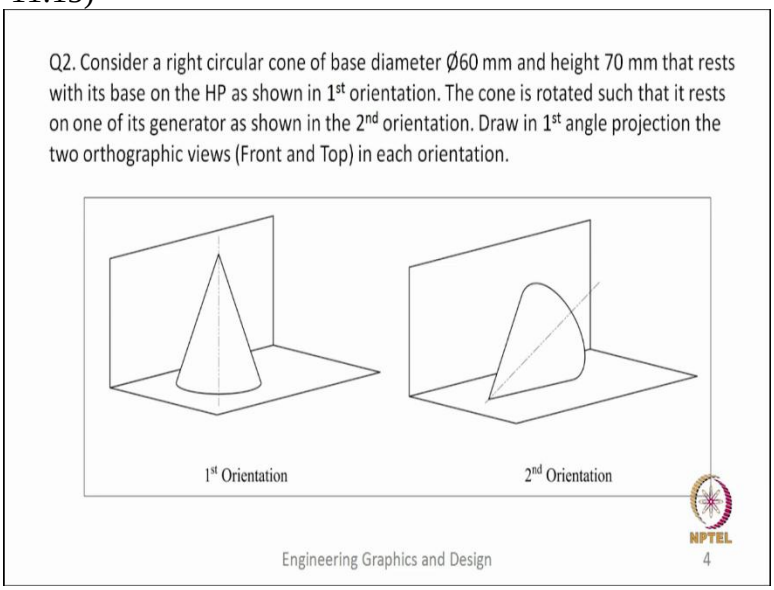

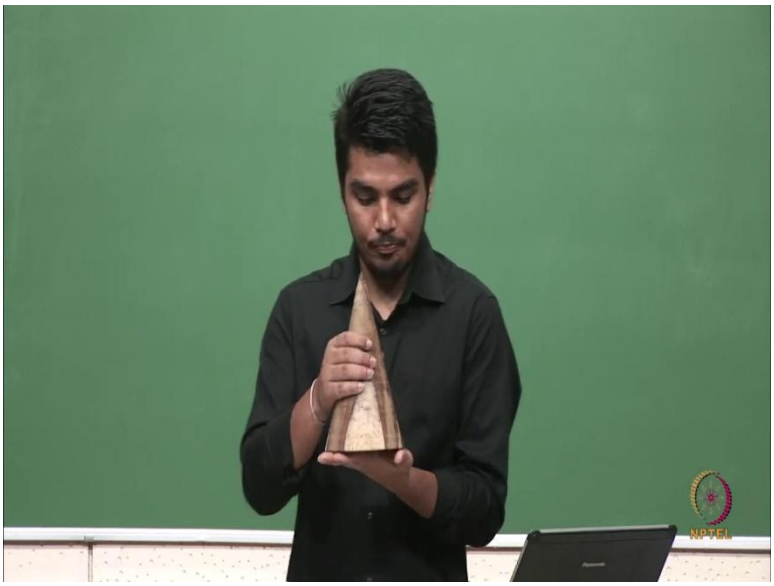

Now, moving to the next question, in which we have a right circular cone of base diameter of 60 mm, and its height is 70 mm. this cone is resting with its base on horizontal plane as shown in first orientation. The cone is rotated, such that it rests on one of our generator as shown in second orientation. And we need to draw the front view and top view for both these two orientations. In first orientation, we have a cone of base diameter 60 mm and height of this cone is 70 mm.

So, this cone is resting on horizontal plane. So, the distance between horizontal plane and the base of this cone is 0. Now, on seeing from top, what we can see is a circle of diameter 60 mm.

And on thing from front, we can get a triangle having base of 60 mm and the height of 70 mm. So, let us draw it. We will first draw the top view followed by the front view.

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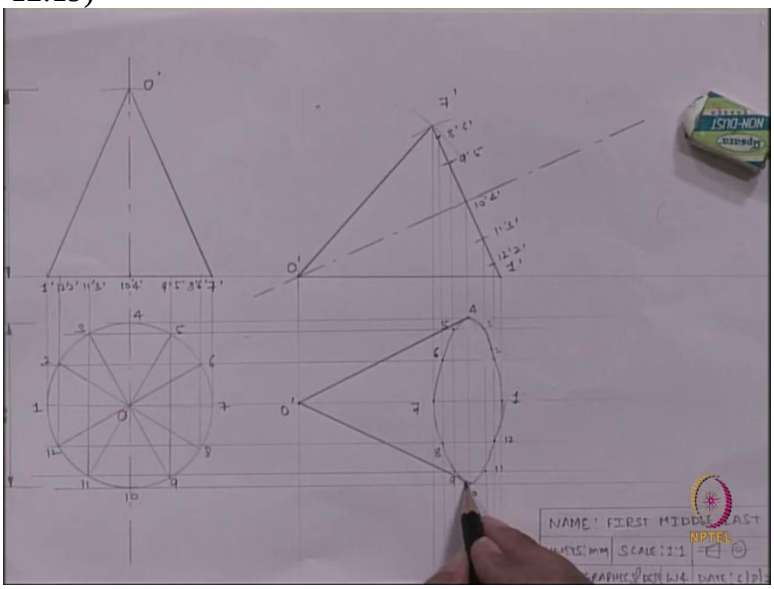

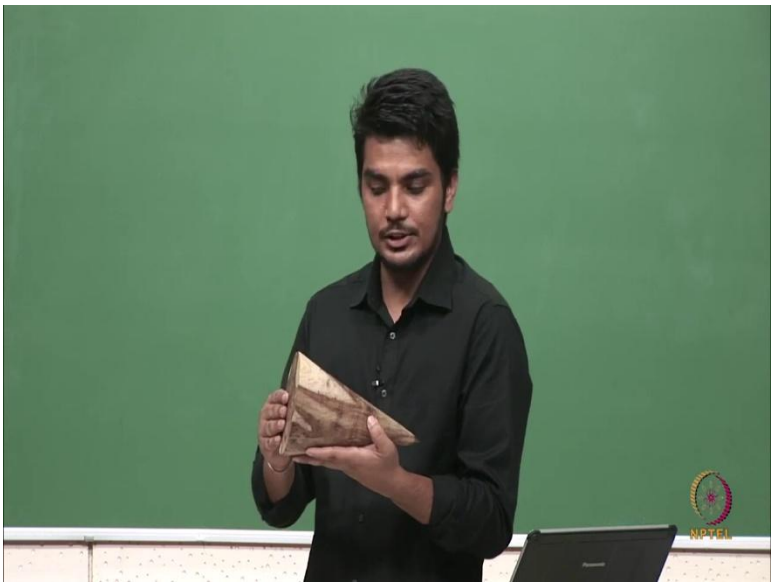

We have the reference line. Now, taking an arc of 30 mm and drawing a circle, having 60 mm radius. We can take random point below the reference line. Since, the distance between the apex or any of the point on the cone from the vertical axis is not given. This is our top view. Now, for front view, we will use the projection lines. In front view, we have a triangle with base of 60 mm and a height of 70 mm. So, let us draw the axis of this cone first.

Now, taking an arc of 70 mm, we will make an arc of radius 70 mm. And we will join this with the base, so that we can get a triangle of 60 mm base and 70 mm height. Now, labeling it, this is apex. Let us say this is 1, 7, 1', 7'. Now, let us dimension it. The base of the cone is 60 mm in diameter and the height of the cone is 70 mm.. In this way, we will get the front view and top view for first orientation.

Now, moving to second orientation, in this orientation, this cone is rotated in such a way, that one of its generator is resting on a horizontal plane. So, this is our first orientation. Now this cone is rotated in such a way, like this. If this is the horizontal plane, its one of its generator is touching the horizontal plane. Now, on seeing from front, we will get the same triangle as obtained in the first orientation.

But on seeing from top, since this base of the cone is not perpendicular to the horizontal plane, so we will get an ellipse. Again, we can visualize it on seeing from top, this base of the cone can be seen as an ellipse. And its surface can be seen as a triangle. So, we will start with front view followed by the top view. In second orientation, this slant height will be there on reference plane. So, we randomly take a point and make an arc equal to the slant height.

Similarly, since two slants are equal, we make another arc. Now, for this base, we will measure this length and draw another arc. On joining these three points, we will get the front view for second orientation. Now, let us label it. This is o', this is 1' and this is 7'. We know, if the front view of these points is here, its top view will exactly below these points and also, we know that, we know the distance between all these points and VP is same in both orientation.

So, I am drawing projections from the previous view as well as from this front view. Now, drawing the projections. This base circle, which is circled previously in first orientation, now get converted into ellipse. So, to draw the ellipse we will convert this circle into 12 equal parts, as discussed in the class. These all lines are construction line, these should be light and thin. Let us label it 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

Just get the projection of these points on front view and again labeling them 12', 2', 11', 3', 10', 4', 9', 5', 8', 6'. Similarly, we are just projecting these points, taking these points into the next orientation. Similarly, measuring this length and making an arc in the next orientation. Similarly, the mid one. Now, make, we will draw the axis of the cone.

And just labeling them, in the same manner as, as done in previous orientation. Since, these all points have front view at these points, the top view of these points must be there below these points. So, we will project these points, using projection lines. Similarly, we will draw the projection line from the previous view. These all line should be thin and light. Now, labeling these points.

This is 7', this is 1', this point is 6', sorry 6 only. Similarly, this dash should be omitted 7, 1, then 6, this is 5, this is 4, 3, 2, 1, 12, 11, 10, 9, 8. Now, join this point with freehand, we will get the ellipse. Now, joining these two. So, in this way we will get the front view and top view for both the orientations. Thank you for your attention.