Engineering Drawing and Computer Graphics
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Module - 05
Lecture – 45
Sections and Sectional Views

Hello everyone, welcome to our NPTEL online certification courses on Engineering Drawing and Computer Graphics; we are at module number 5, lecture 45. In this module, we will mainly focus on Sections and Sectional Views; when do we require this sections and sectional views, what are the importance of the sections; these are the things what we are going to learn in our module number 5. Let us begin our sectional views topic.

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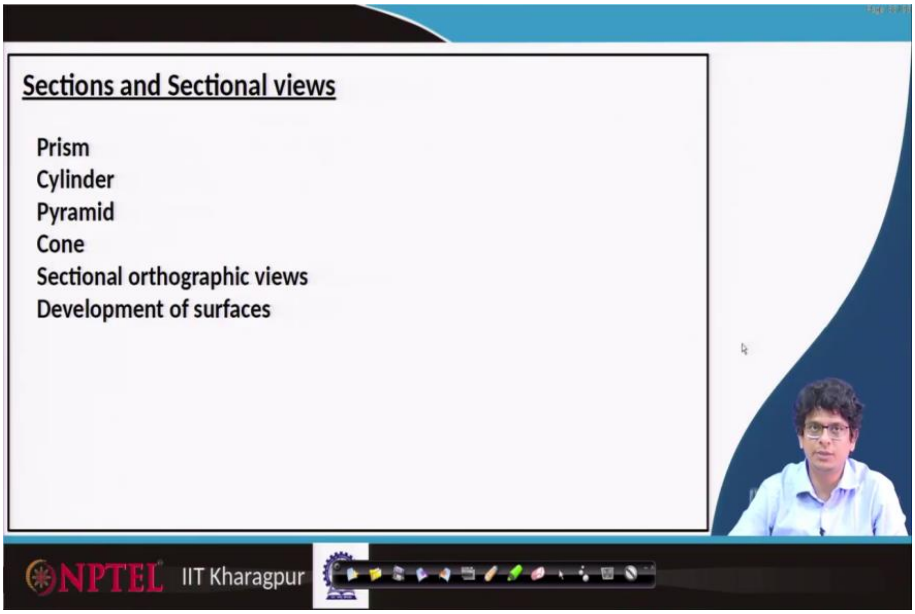

Mainly to represents prisms, cylinders, pyramids, cones or perhaps assembly drawings where different parts have been assembled, joined together; to understand these intricate details we require sections.

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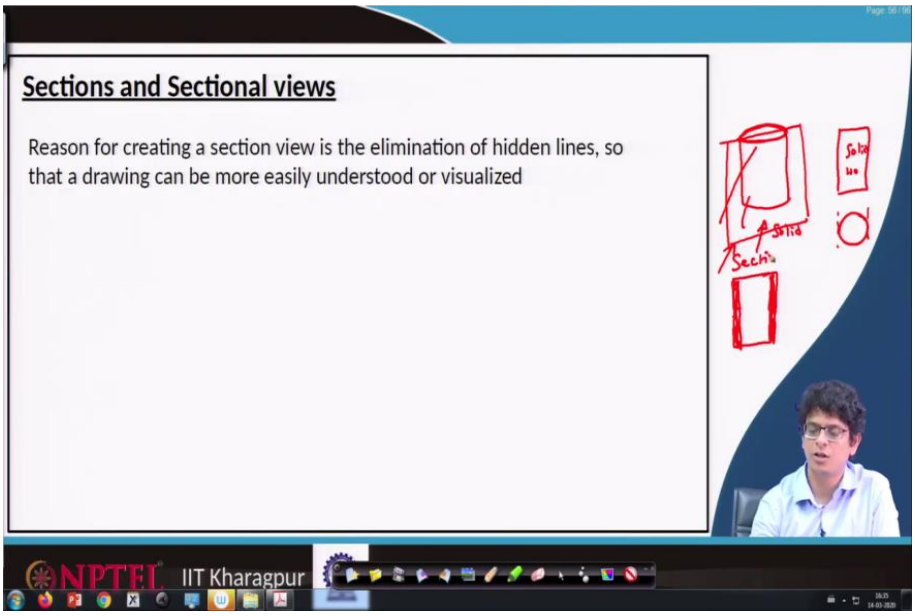

The main reason for creating a sectional view is the elimination of the hidden lines so that a drawing can be more easily understood or visualized. For example, if I am drawing a cylinder in the drawing if I would like to represent, perhaps the views will be the front view and top view of that, we represent it in that way. How to know, whether it is a solid object or a hollow one? To represent that, we require this kind of sectional views.

For example, if it is just a sheet metal, a very small thickness when we are representing it; at the front view, we do not know whether it is a solid object or it is a hollow one. Unless we make a cut section remove this first part and show something like, where sheet metal can be represented by a thick line; that indicates that material might be present within that red portion and the white portion, there is no material.

For that purpose, we require these sections; more details we will learn during the class.

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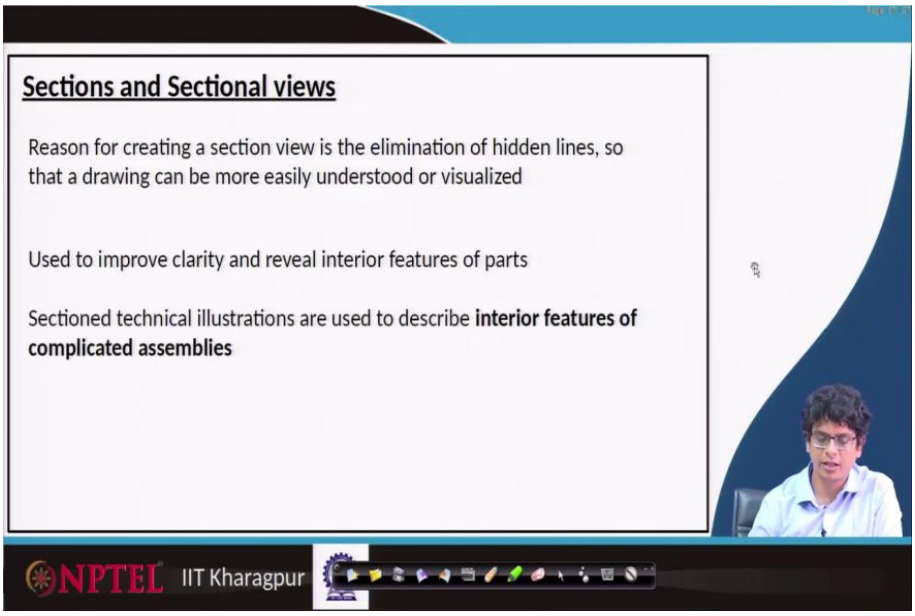

Usually, these sections representation helps us to improve clarity and reveal the interior features of the parts. And these interior features of very complicated assemblies are always be preferred on this sectional planes.

For example, we have a monitor, in front view, we will see something like a rectangular portion, but inside what it is there we do not know. So, for that purpose, usually on drawing sheets, whoever so manufacturing these computer monitors or perhaps trying to know about the individual components of that monitors.

The best part is, they will represent something like a sectional view, making a slice which passes through this computer monitor. So, the top part will be removed and the bottom part can be visualized so that we will understand what kind of electronic components are present. And that kind of drawings usually we circulate across this production line.

So, this is the way one has to make assembly; for that point of view, the sectional views are very helpful.

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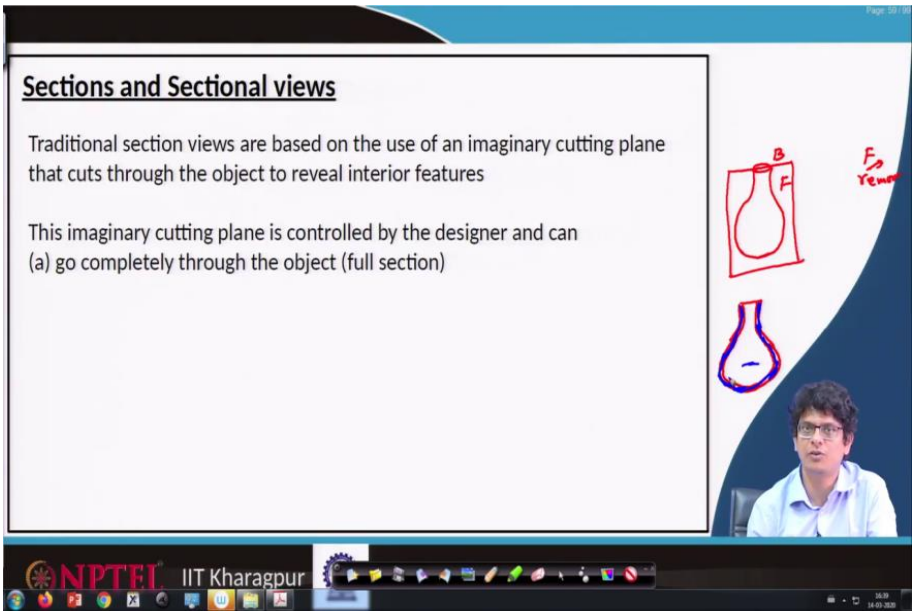

Or perhaps we have a writing pen. So, from the front view, the top view we just see something like cylindrical portions with conical portion and so on. But whether inside, a thin refill is present, the thick refill is present; how to know about that on the drawing sheet?

When you are communicating with other assembly plans, usually you circulate these drawing sheets on which it is represented like; if you have to have this sectional representation, perhaps such kind of refill one might be using it. For that point of view also we require these views.

So, traditional section views are based on the use of an imaginary cut plane that passes through the object to reveal interior features. It is not that we slice it, but it is more like an imaginary process; if one can have that kind of sectional thing, in inside pass how do they look like.

This imaginary cut plane is controlled by the designer and can go completely through the object; if that is happening, we call the full sectional view. For example, we have a water bottle and if we are going to have something like this plane, slice it.

So, let us call backside part B, front side part F; remove this front side part. And if you are looking backside part, it looks like; perhaps if it is made with a plastic a very thin material, this is the part where we have this plastic material and the remaining place is empty.

So, to represent this kind of things, we use certain kind of protocols; whether we should darken those lines or show some kind of inclined lines, hatching and so on; this kind of representation what we will learn for this sections and sectional views chapter.

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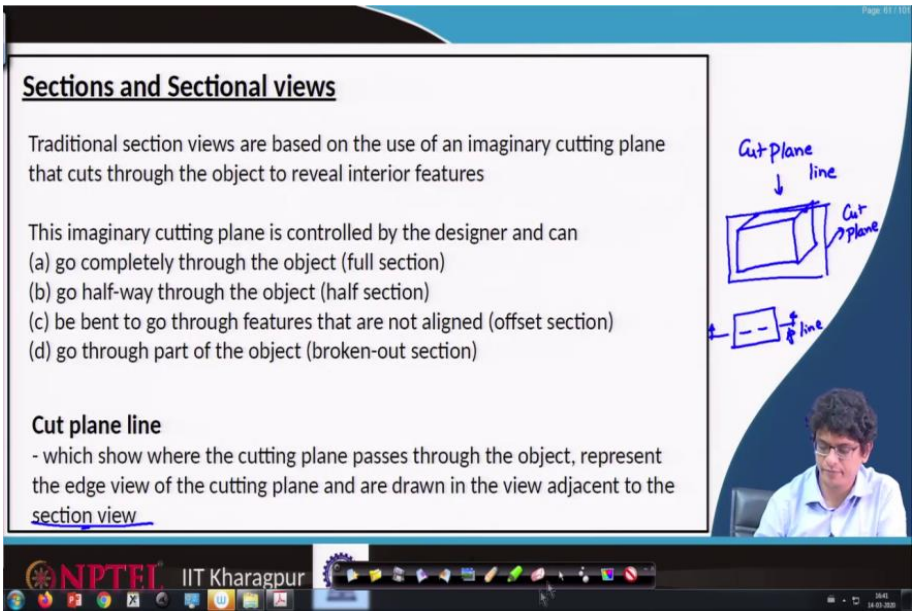

Instead of removing the complete full section, one can make half-section also; it is more like go halfway through the object. Sometimes sections can go neither normal nor on this horizontal things, but some bent kind of views also one can make it.

Very complicated ah objects if they are present; unless we show that bent kind of sectional views we will not be in a position to understand what is there inside of that material. And sometimes it completely goes through the part; but something named broken cut sectional views, more details we will see later.

A cut plane line is the one which shows where the cut plane passes through the object; it represents the edge view of the cutting plane and is drawn in the view adjacent to the sectional view. So, two concepts are important; one is the cut plane, the other one is the cut plane line.

For example, we have a block; maybe cut plane is that, which pass through these points. When we are looking from a top view; it looks like there is a plane which passes through this material with certain arrow representation we will give. And this one what we call line, cut plane line and this one is called a cut plane.

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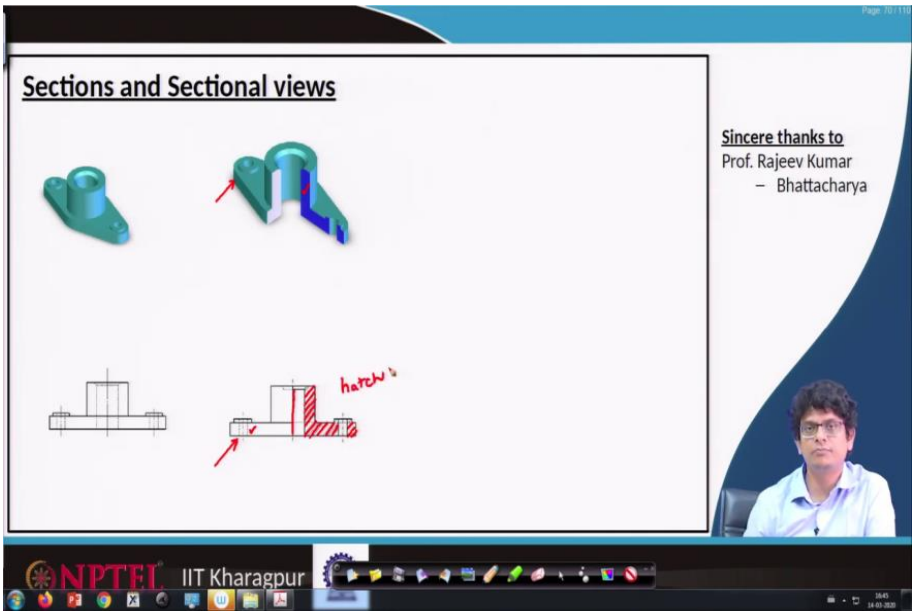

Let us take an example, here we have an object; these are the holes through which it can be bolted and this is a hallow portion inside and we have a slight taper on that side. If we make a cut section; perhaps here cut section what we are trying to do is, up to that part remove it, similarly up to that part remove it. So, if we can remove this part, the leftover part perhaps looks like that.

By doing this the advantage is, we can see up to which length this bolt can go; here it goes all the way down. Second thing, we have a step; the step can be seen. And the third one, here inside whether the taper is there or not that we can see that.

And the thickness of that material can be seen. And further, whether this same thickness we will see it on both sides or not; this kind of intricate details we can easily observe through this sectional views. So, on the drawing sheet, instead of representing these complex three-dimensional shapes; usually we go with 2 D sketches, especially the projections, orthographic projections.

And if it is about this object, having a front view in this direction; we will represent this end, this end matches with this. And we have something like a bolt insertion kind of position, that we can represent it here; similarly, this one we can represent it there.

And it is hollow inside that for that we have these dashed lines; this is a tapered one that is the reason we have that tapered one. And it is hollow, so again we have that hallow, all the way we have this hallow portion which goes all the way down; this is the way we represent the front view of this pedestal kind of bracket.

In case if we have a cut section, we can see the material and a 2 D level representation; we can show only that part, where this hallow portion one can note it, up to which level. And this is the plane through which this cut section is really passing through and material is present there. So, usually, we show 45 degrees inclined lines, where the material is present.

And that is what we call hatching, hatch. One can have complete section show that; but it is because of the symmetric ah object, the same thing one will be in a position to sense it on the other side. So, it is a minimalistic way of representation, representing figures.

One can have a full section show the same object, instead of that usual the standard convention is; if these are symmetric kind of objects, one-quarter of the portion one can remove it, the remaining portion one can show it by hatched lines. And this is one view of that object, the frontal view.

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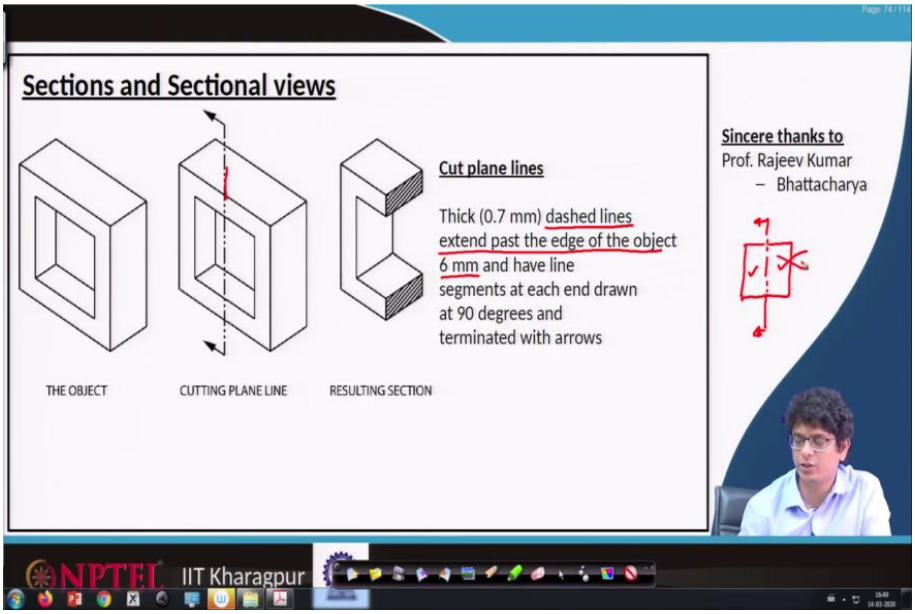

For example, if we have this kind of box, block; if there is a cut plane, we have chosen. Observe that arrows are pointing in that direction and there are a dash small dashed lines; so, a very long dash followed by two small dashed lines goes all the way. These are not just stopping on the object, but extend on the top side and bottom side.

And there is some arrow representation. And if we do that, usual representation is in the direction of arrows; we keep the object away from that remove the remaining portion. So, arrow direction is in this way; that means this part we will keep it and this part we will remove it.

When we remove it, after making a slice in that direction; similarly, when you have a section; through the cut plane, if you are removing it, there is no material here, it is just blank empty vacuum that is

the reason we have an empty thing. But this is the portion where we have material, that material what we are representing by this. Similarly, the material is present there. This is the way we get the resulting section. Usually, the cut planes represented by a thick dashed line that extends past the edge of the object; this is the edge of that object, but it passes ok over that, 6 mm.

So, minimum 6 mm length one has to show; when you are showing a section. For example, if the object is this; you want to cut, you do not just show it in that way. What you do is, represented by these dashed lines; We want to keep this one; then arrow direction supposed to be in that direction and this is the one which we would like to remove. And the segments at each end drawn at 90 degrees and terminated with arrows; so, this always is having 90 degrees.

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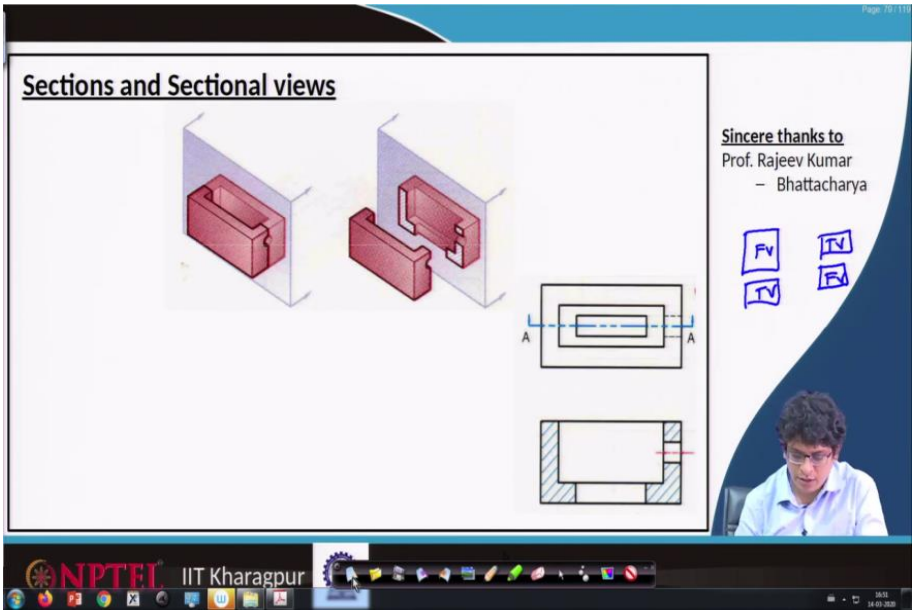

Let us look at another example. Here we have a block, which is having a hole inside of that; perhaps there is no hole on this side and we will like to consider a sectional view of this entire block. A sectional cut plane is an imaginary plane, this is the one.

This pass through these lines and arrow direction is in that way; that means we want to preserve that view and remove this part. So, this part comes out and the remaining part we represent; because it is a sectional view, we always have this material portion represented by hatched lines. Similarly, here hatch and similarly this one.

And note the arrow direction. So, if we are looking at the front view of the object and top view of the object, we can see that; we would like to view front view in this direction, perhaps we would like to

visualize from bottom side one way or we would like to view from this direction as a front view, and the remaining top view whatever we would like to visualize that we might be showing it in that way.

Now, if we are using first angle projection; your front view at the top and top view at the bottom. If one is going with third angle projection, your front view and top view. So, based on those view directions, we can see that the front view portion have that material element.

However, because of view, this point maps there and we will be in a position to see this line and also this one. So, we will be in a position to see this complete portion. And there is a tiny hole passing through that, that we can represent by this long dash dashed line; this is the way we get a sectional view of the object.

Usually, the section will be represented in another view, maybe here in the top view, where the section has to be considered on that object which is passing at the middle layers of that block. And we want to remove this portion, keep the view of that; then naturally arrows, we will represent at in that way.

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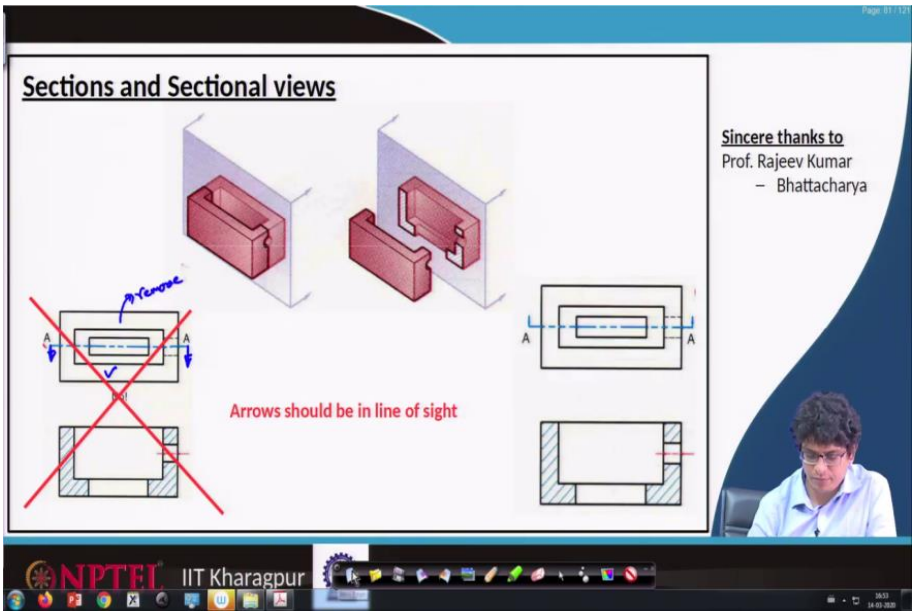

We should not show arrows in this direction for this object; it indicates that we want to retain this, but we want to remove it, whereas the case is the other way around. So, arrows should be in the line of sight.

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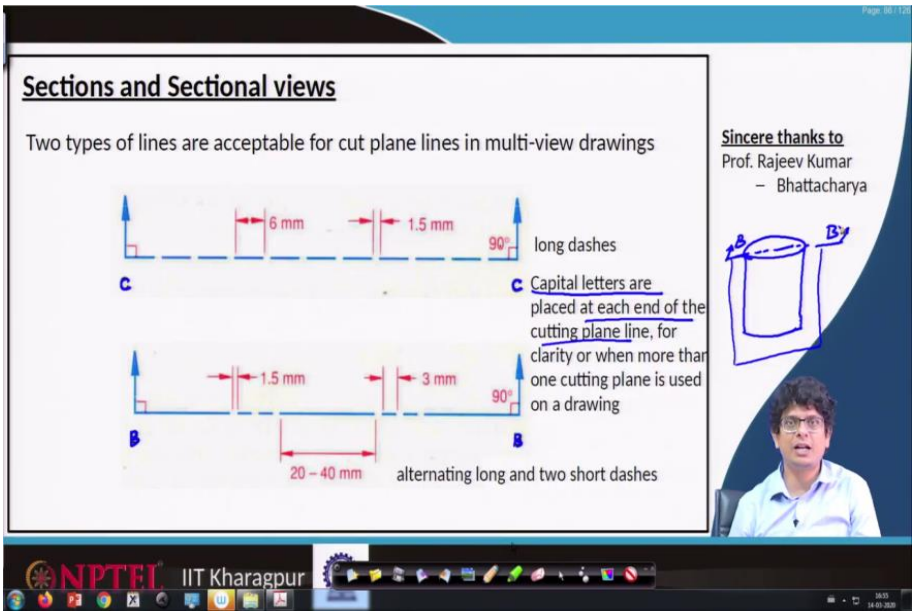

There are basically two types of lines are acceptable for this cut plane lines; either by showing long dashed lines with each dash of 6 mm and the gap between these long dashes will be 1.5 mm, and the arrows always are representing 90 degrees line. The other way is showing long dash followed by two dashed lines and again long dash. So, a long dash, small two dashes followed by a long dash; the gap between these long dash and the short dash is 1.5 mm.

Usually, this long dash will have around 20 mm to 40 mm in length and short dash usually have a length of 3 mm; and for this cut plane, we always use capital letters and these are placed at each end of the cut plane; so, here if you are seeing cut plane C and C and B and B.

For example, for a cylinder we want to make a cut plane; this is the cut plane direction. So, long dash followed by two small dashes, long dash followed by two dashes and so on. We want to retain that side view, then this is the plane. And usually, this one ends with B B, A A and so on;

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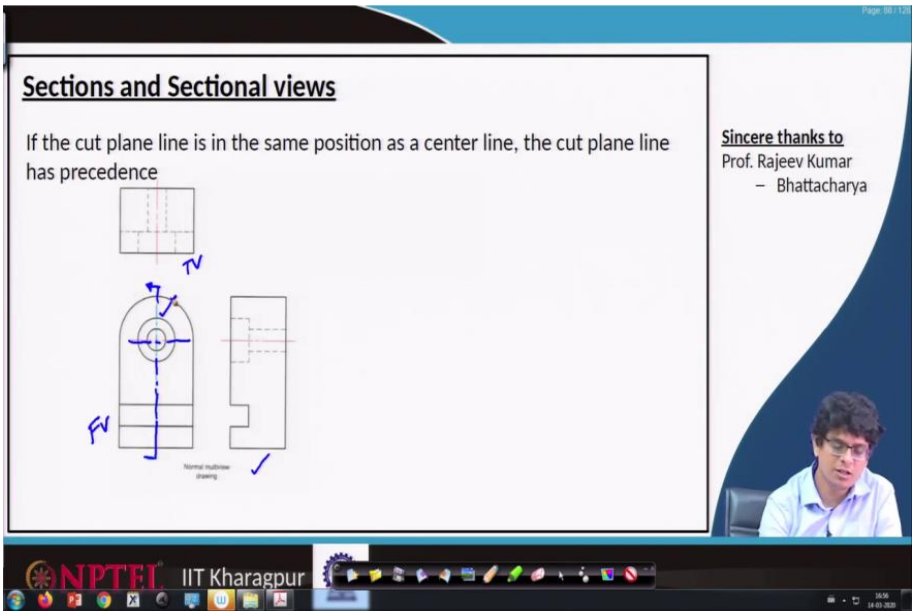

And if these are cylindrical kind of objects centre lines are there; then cut plane line always have precedence, compared to axis or centre line. Let us look at that object. For example, here we have a front view, a top view ah; if it is in third angle projection and a side view we have it.

So, here we have something like a long dash, short dash, long dash just to represent the centre of that circle or perhaps circular location. And here we are showing long dash followed by two short dashes, long dash and so on as a sectional view.

When we have such kind of thing, we will represent only that sectional view representation; but we do not show, we do not show anything like long dash, short dash, long dash to represent the centre. So, compared to the centre line, we, if there is a sectional view line, is present, cut plane line; then one has to show only that cut plane line.

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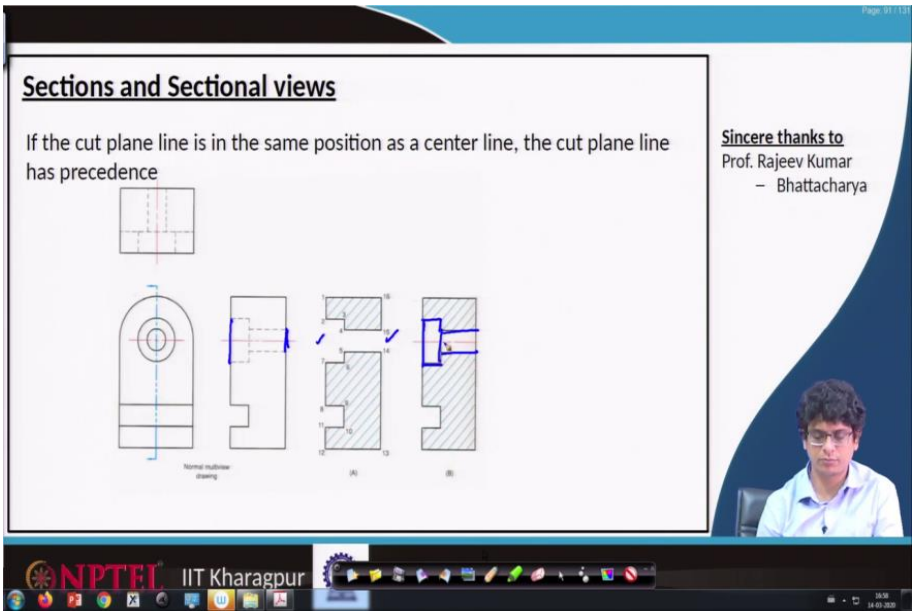

So, if we are removing, this part, the section what we are going to get is these views; because we are removing this part because arrow direction is in this direction. So, we want to retain that part, remove this part.

When we do that, on the side view; we can see that this is the place where the material is present, represented by that. And because this is a hollow portion, this is also a hollow portion; so we do not have any lines there, it just looks like a floating one. Similarly, we have extra material and taper kind of thing then naturally we will have this portion.

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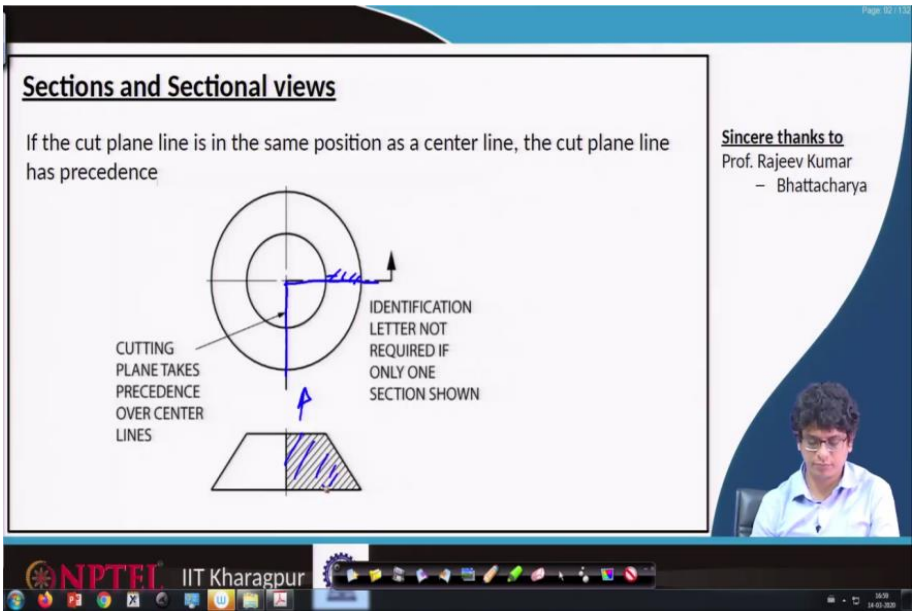

If we have frustums, cylinders, tapered kind of things; we always have the sectional view representation only on that one-fourth of that quarter. So, instead of showing a complete half, full section kind of thing; we use to remove this part. When we remove that part; if we are looking from this side view, there is a material present in this zone and that is the one what we are seeing there.

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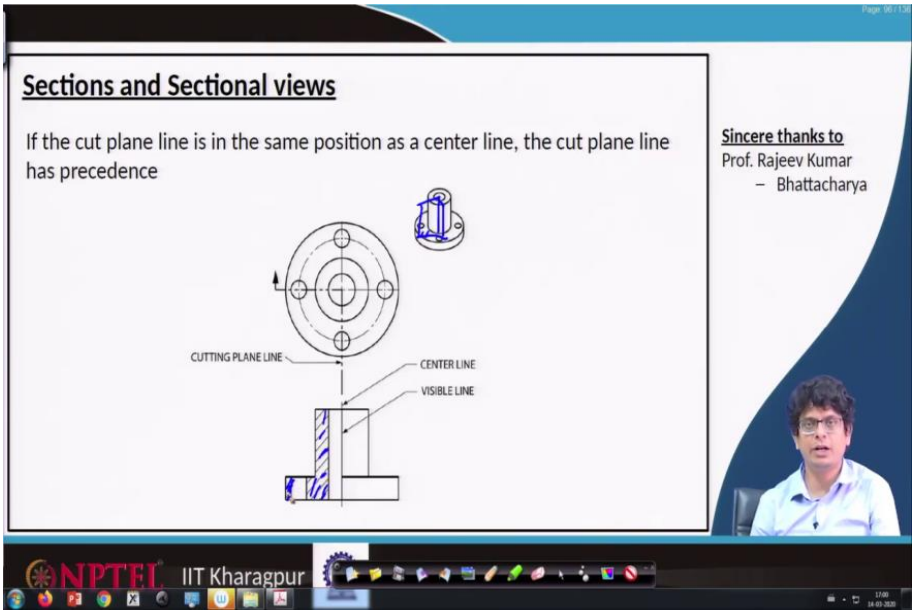

Similarly, we have this object, which can be bolted at these four locations and it has this cylindrical portion. Now, from the top view, if you are looking at; it will be having a circle and there are inner circles also surrounded by this small bolted kind of portions.

And the section we would like to consider is this one, and long dash followed by two short dashes and so on. And we would like to retain that part and remove this part. If we remove this entire part; then we have material within that portion.

So, we have that material within that portion. It goes all the way to top; because we are considering removing this part, in that way we would like to remove it. When we are removing that part, this one having material, this one having material; the remaining part is as usual like top view whatever it gives.

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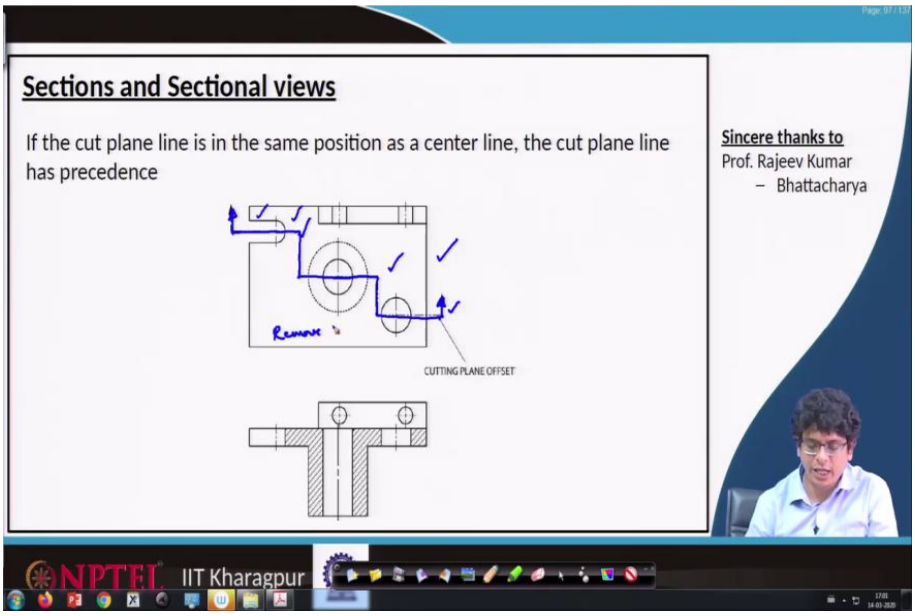

Similarly, these sectional views may not necessarily to be on one view; like the front view you can take a section or top view, it can be bent and kind of sections also. For example, here look at it, this is the object what we have; first of all, have a section, retain this part, again have a section, again have a section, again have a section and keep this part, that means keep this entire thing and remove this part.

If you do that, let us look at that; this is the part what we are removing and this is empty. So, we have empty here and this is the part which we are removing. So, we have the dashed one and this entire thing we can not see it from the front; but again here we have dashed line..

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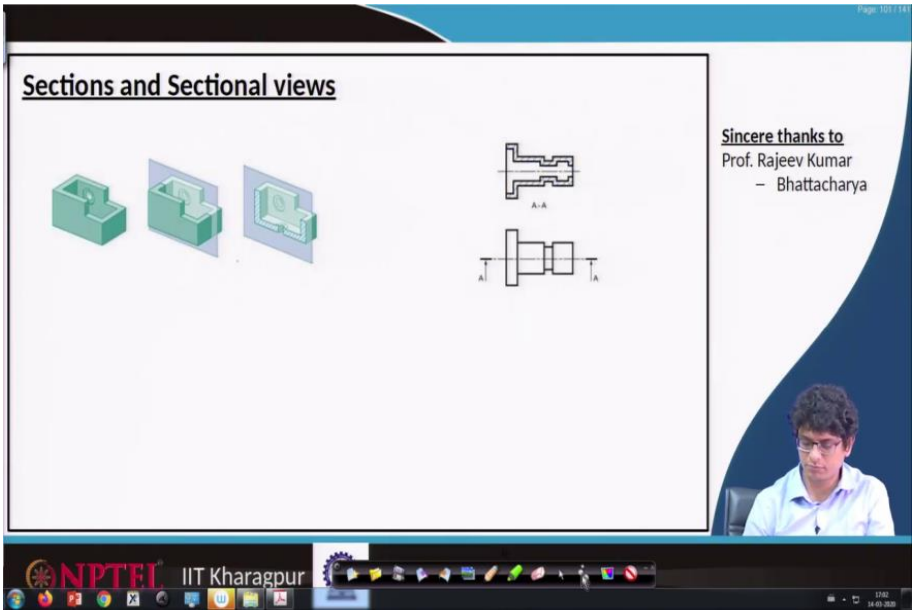

Just to give you a perspective view, this 3 D object if we are having a slice and keeping this section in that direction, removing this part; then the view supposed to be like that. Note the hatch directions where the material is present; because the section is considered only here, but not inside of that circle, that is a reason circle is complete.

Similarly, here we have a solid of revolution. If we are taking a cut section; here you can see, long dash followed by two small dashes and so on. Another representation is here we would like to keep that part and remove the remaining part. Then wherever the material we are removing, this sectional thing; we have leftover material there, the remaining part is empty.

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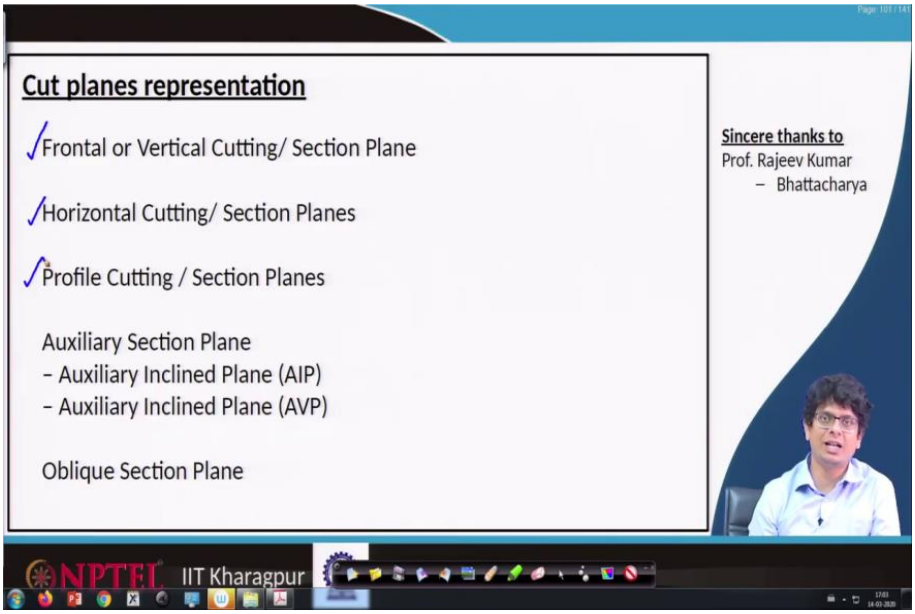

Usually, cut planes are represented in different styles. There is a frontal or vertical cutting plane; one can have horizontal cut plane also, sectional planes are profile cut one can have.

The other one is the planes what we have learned like auxiliary planes; on these auxiliary vertical plane, auxiliary inclined planes also we can have cuts; so, such kind of things are what we call auxiliary section planes and also one can have oblique sectional views.

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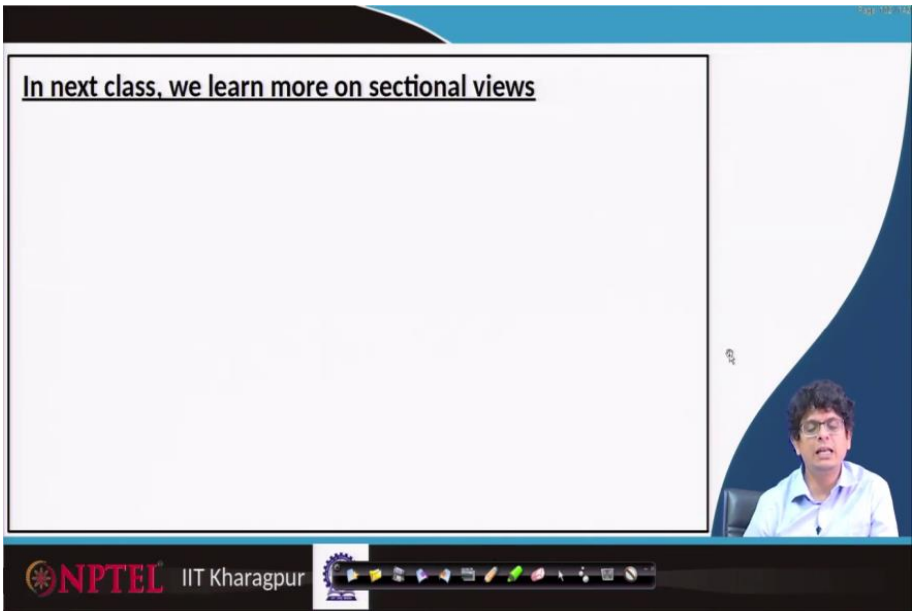

In the next class, we will learn more about the sectional views and represent them on the drawing sheet.

Thank you very much.