Engineering Drawing and Computer Graphics
Prof. Rajaram Lakkaraju
Department of Mechanical Engineering
Indian Institute of Technology, Kharagpur

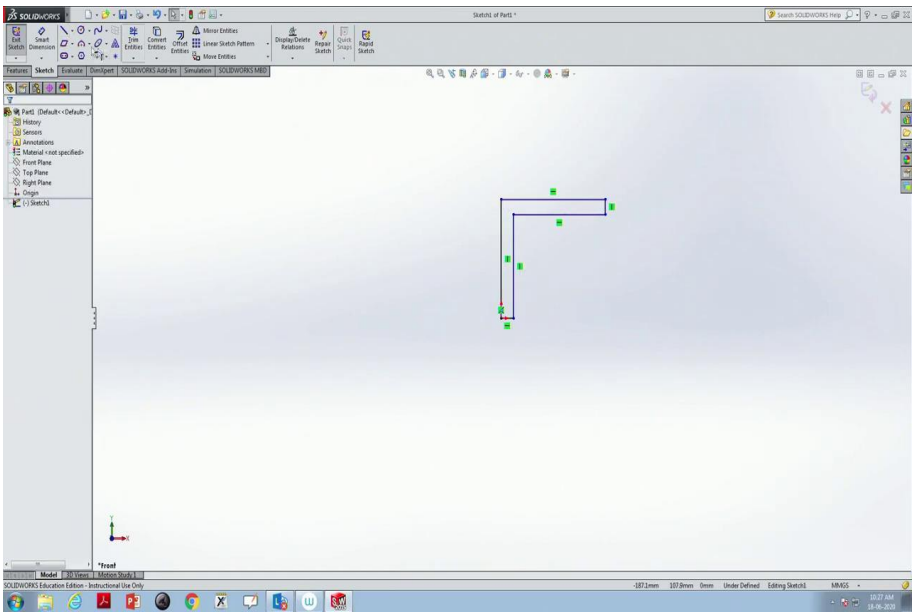
Lecture – 60
Solidworks (Contd.)

Hello everyone, welcome to our NPTEL online certification courses on Engineering Drawing and Computer Graphics. In the last few classes, we learned some of the concepts in Solidworks; advanced concepts in SolidWorks from today onwards, we will learn it.

The first thing is constructing a reference plane. For example, we know how to use a front plane, top plane and right plane. If we have that kind of surfaces, we will be in a position to draw a sketch; then use extrude options, extrude cut, extrude boss, perhaps fillet this kind of objects we can construct it.

However, if the object has a different kind of surfaces; inclined surfaces, curvy linear surfaces which are bit offset. How to construct such kind of surfaces? That is the thing what we are going to learn it under the name reference plane.

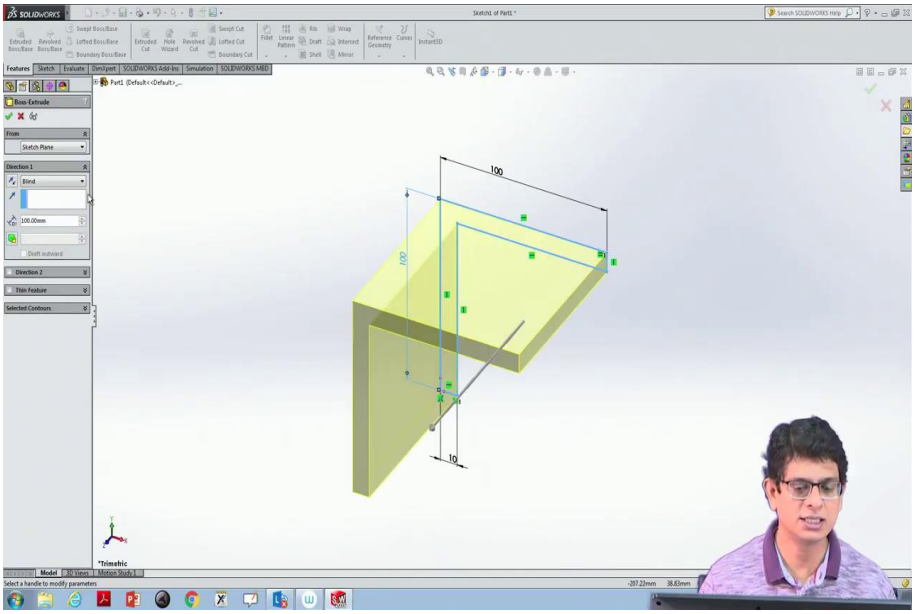
(Refer Slide Time: 01:11)



So, now let us open the SolidWorks.

Now, let us construct an object on the front plane. I will construct an l angular kind of bracket with inclined surfaces. So, for that purpose, what I am going to do is, use a line, maybe begin with one point, go there; typically to support mechanical object, we use this kind of L angular brackets.

(Refer Slide Time: 01:55)

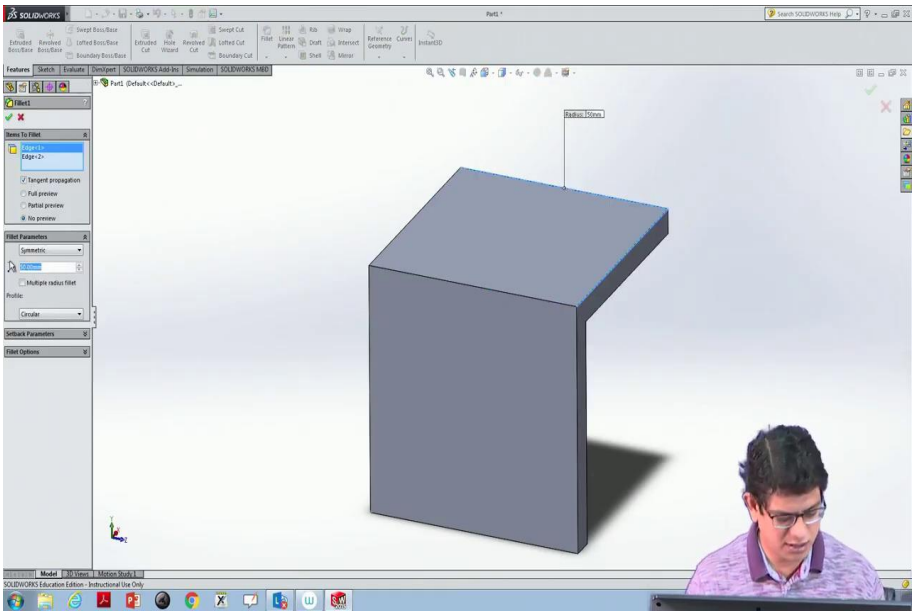


Now, I would like to use smart dimensions to maintain something like 100 units for one of that length; similarly this one also 100 units. Now, this side flange thickness, control and this side flange thickness.

So, select that first one control hold and pick the second one; then make it an equal option. By doing that, whenever I am going to change the dimension of one side of the thickness; the other thickness also changes, for that purpose we are going to use this equal symbol.

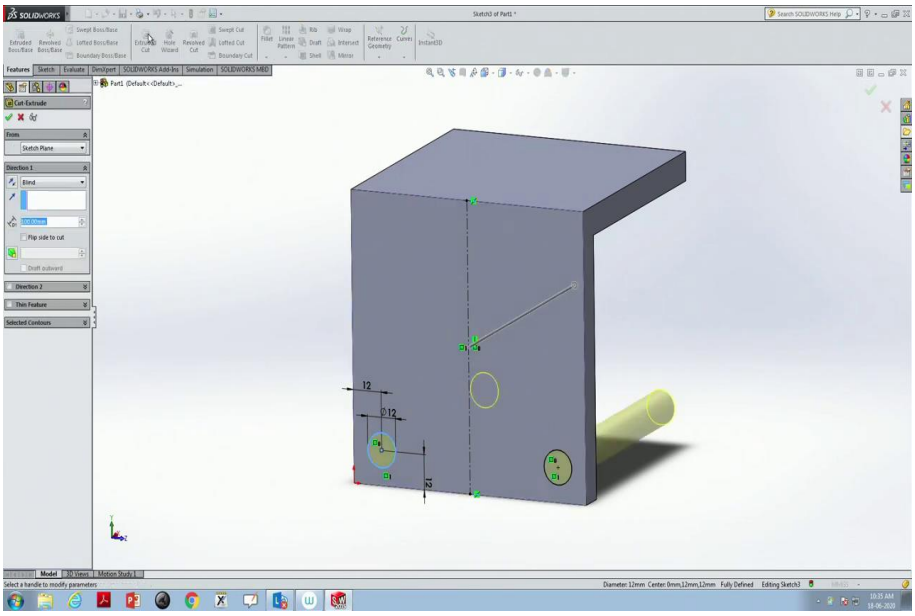
So, now go to smart dimension, maintain this thickness as 10 units; so another side also appropriately change. Now, this entire thing, we would like to extrude it in 3 dimensions. So, because it is 100 unit in length; so I would like to use the same 100 units to make it like an L angular bracket.

(Refer Slide Time: 03:19)



Now, we do not want this kind of sharp edges; for that purpose what we are going to do is, we use something like an arc and remove those portions. The other way is to use fillet to reduce this short corners. So, select this one and select this one also, use fillet. Here we can always increase that fillet size 50; it is too much, so let us edit that feature, maybe make it 10 mm.

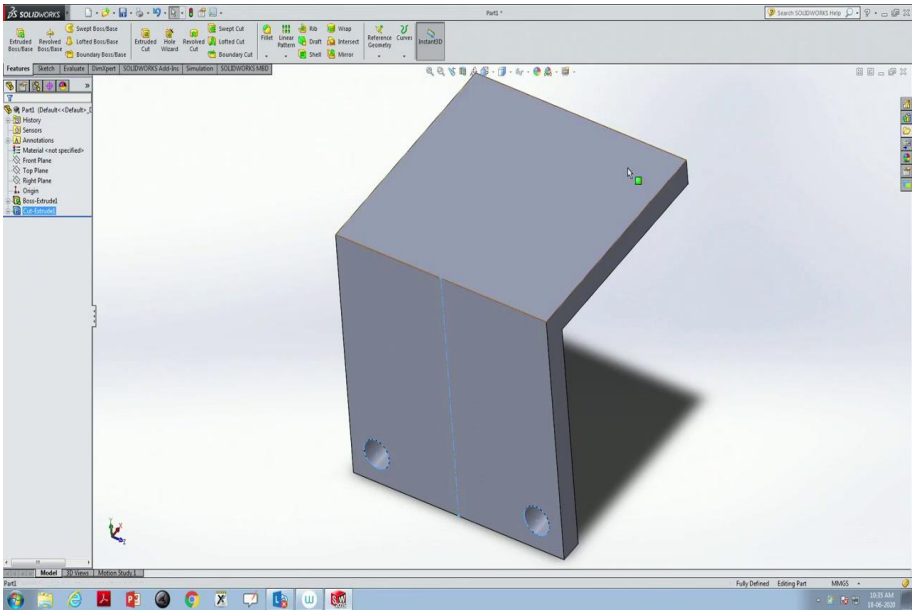
(Refer Slide Time: 04:19)



Now, normal to that let us draw circles, a circle of radius; let us use smart dimension 12 units and this one central point to this one. Let us use smart dimension, pick this centre point to this line also 12 units. Similarly, this point to this point also makes it 12 units. So, it will be the centre of that.

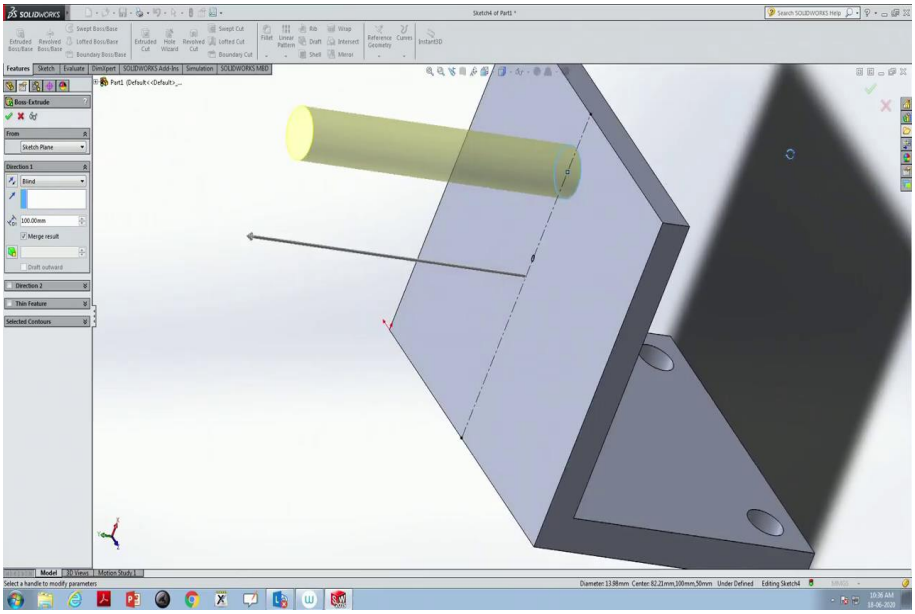
Now, parallel to that select this one mirror, mirror about this line, apply. So, two circles are done. Now, we will use the extrude option to remove these cut portions. So, for that purpose pick this one, go to features, extrude cut; once done, click ok.

(Refer Slide Time: 05:47)



So, we have these holes through which we can put these bolts and nuts.

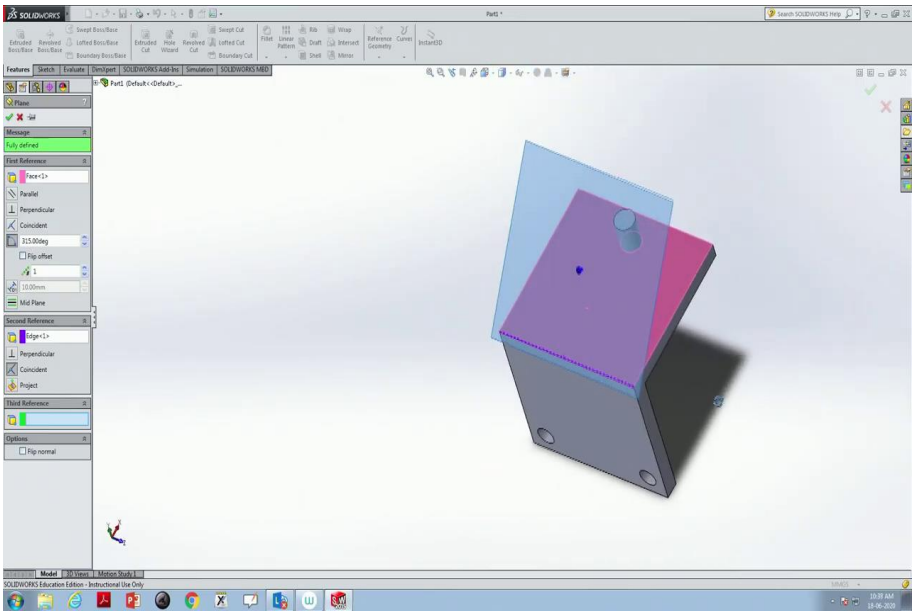
(Refer Slide Time: 05:57)



Similarly, on top of that surface, let us make another circle at the centre. So, now the centre line at this and we want to make this distance to this centre line to be 0. So, that it will be a place centre.

Now, pick this one, go to features; now we would like to have something like a shaft passing through that portion into bottoms side. So, let us make it 20 units, click ok.

(Refer Slide Time: 07:03)

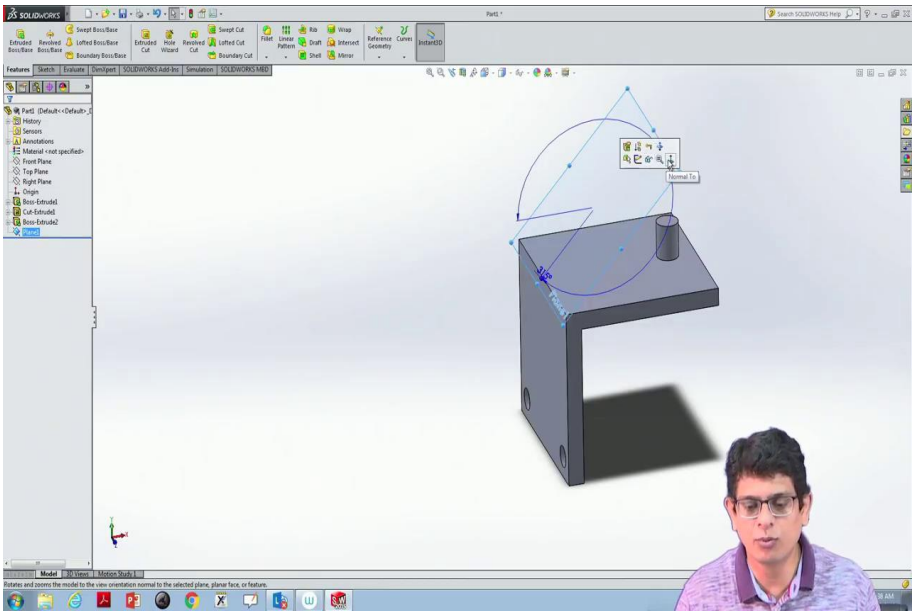


Now, on this surface, we would like to have an inclined surface on which there will be the additional thing. So, to construct the difference plane, first, we will go there click; this is the object and with respect to that same inclination angle we would like to have. So, for that purpose, pick the second reference and change this angle to something 315 degrees.

Now, what we have done is, because we would like to construct an object on that inclined plane. If I pick any front plane, top plane, side plane whatever this, I cannot construct any sketch on that incline; for that purpose what we are doing is with respect to this plane, I would like to construct one more plane, which is passing through this line.

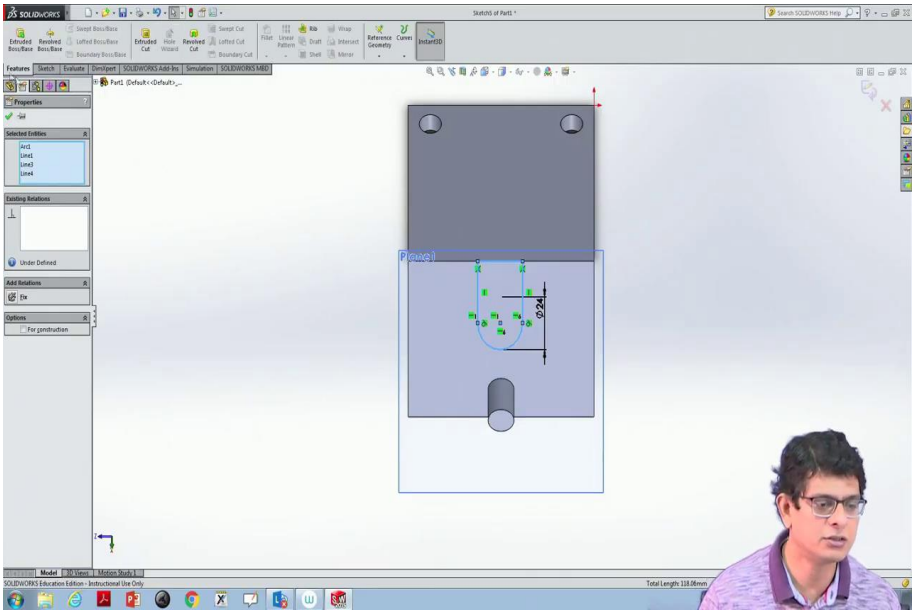
It can be upward direction, it will be downward direction also; instead of 315 degrees, if I am going to make it 30 degrees, it goes down. So, at any arbitrary angle, I can construct a plane.

(Refer Slide Time: 08:27)



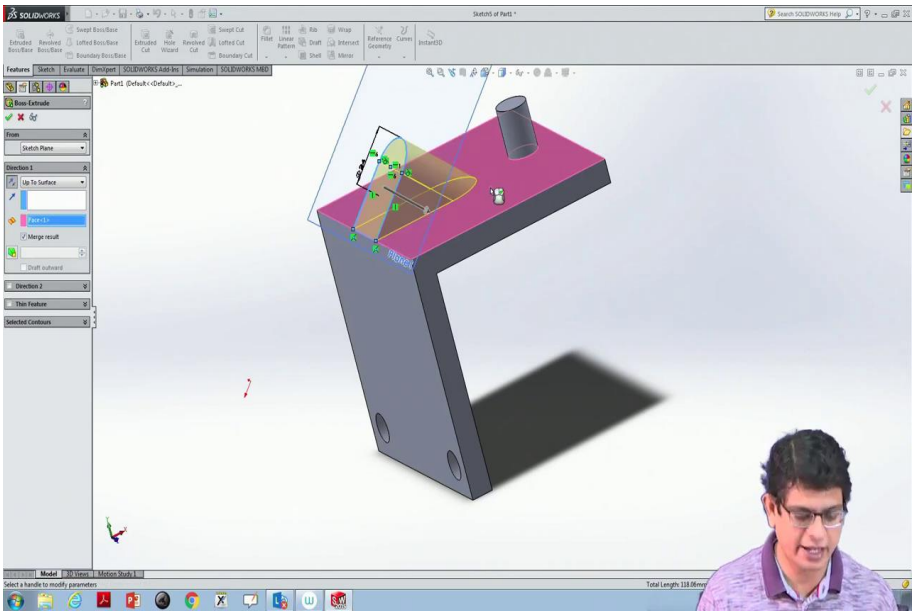
So, first let us keep 315, click ok; once it is done normal to that plane, construct anything.

(Refer Slide Time: 08:37)



For example, I would like to construct a circle here and that supposed to have a unit of 24 diameters. And from there I would like to construct one more line passing through that and tangent to this line. Now, I will go ahead trim this object, click ok; then pick this one, this line, this one, this one to extrude the object, extrude boss base.

(Refer Slide Time: 09:27)

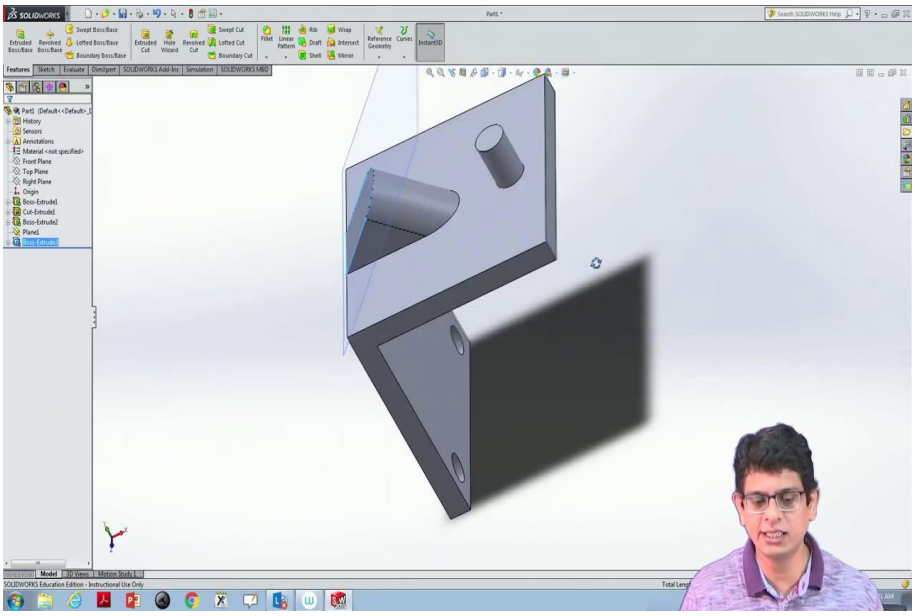


Now, if you are seeing, normal to that surface I can construct a plane. Now, we would like to have this entire constructed object touching the other side of that surface. So, I would like to have a extrude of this object entirely touching this surface; to do that what I have to do? Reverse the direction, so there is up to the surface; so click up to the surface, control button then clicks this surface.

Again I would like to have this entire arch kind of substance to go penetrate this object; up to the surface, I would like to have a projection. If it is the typical extrude thing, it goes either outside or inside of that. For example, let us look at this one control, second, third, fourth this is the thing what I would like to extrude.

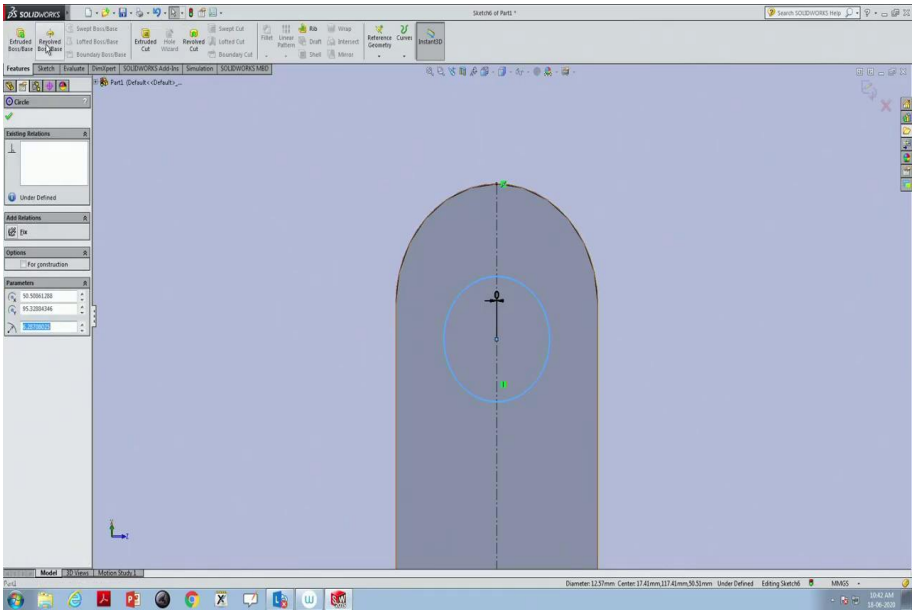
If I use this one, it extrudes out; if I reverse the direction, it extrudes in. And we do not want this kind of semi penetrating kind of surfaces, but up to the surface level, I would like to have extruded. For that purpose what we are trying to do is, instead of blind; go all the way up to the surface. Up to which surface? Up to this surface, we would like to have, then click ok.

(Refer Slide Time: 10:57)



So, if you are seeing that the entire object is extruded up to that surface; whatever that projection is there, we will have it. Now, on that we would like to have one more bolt to be fixed; for that purpose go to normal, now draw a sketch.

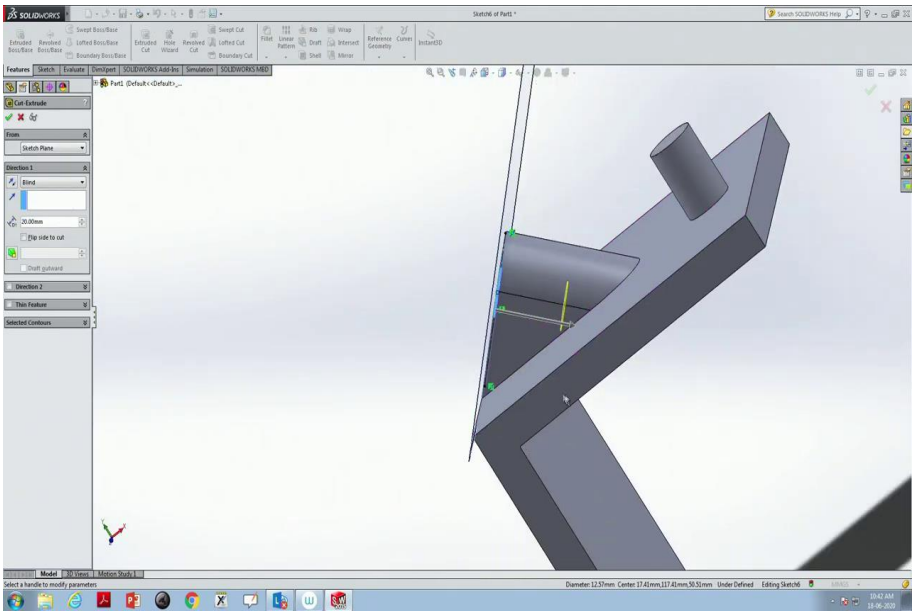
(Refer Slide Time: 11:19)



Maybe a circular hole we would like to have and it supposed to pass through centre line. So, now, zoom in this portion, use smart dimension; pick the first one control button, centre line, click ok, then make it 0.

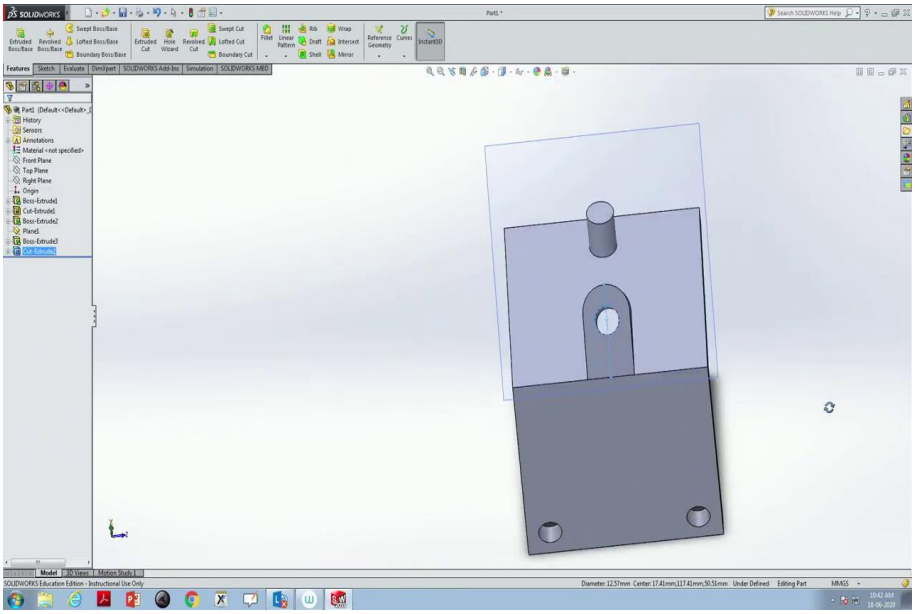
Now, we would like to make a hole out of that. So, click that one, this one, go to features, there is extrude cut. Now, let us look at it.

(Refer Slide Time: 12:19)



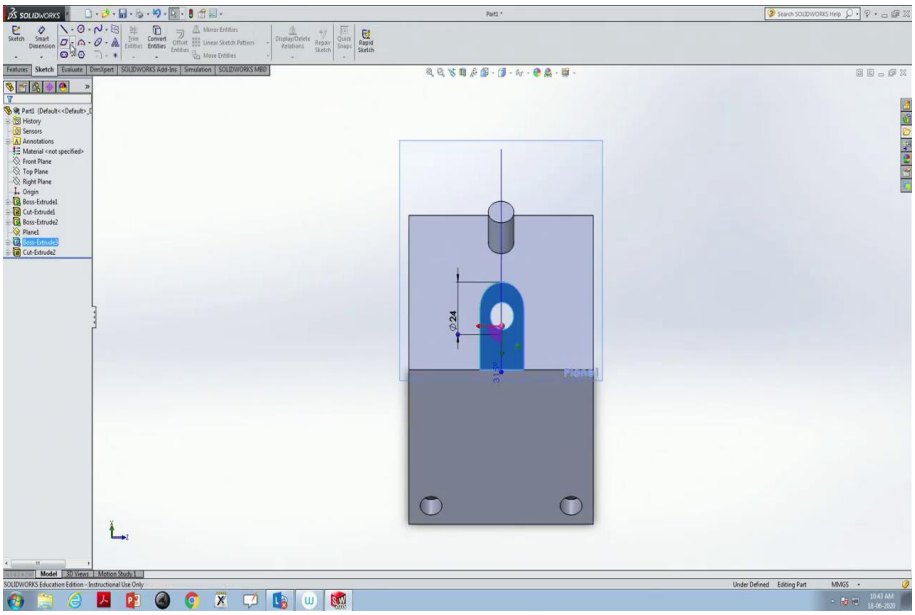
If we want a complete cut, we can make it to maybe 50 mm. So, it goes all the way out of that hole, clicks ok.

(Refer Slide Time: 12:45)



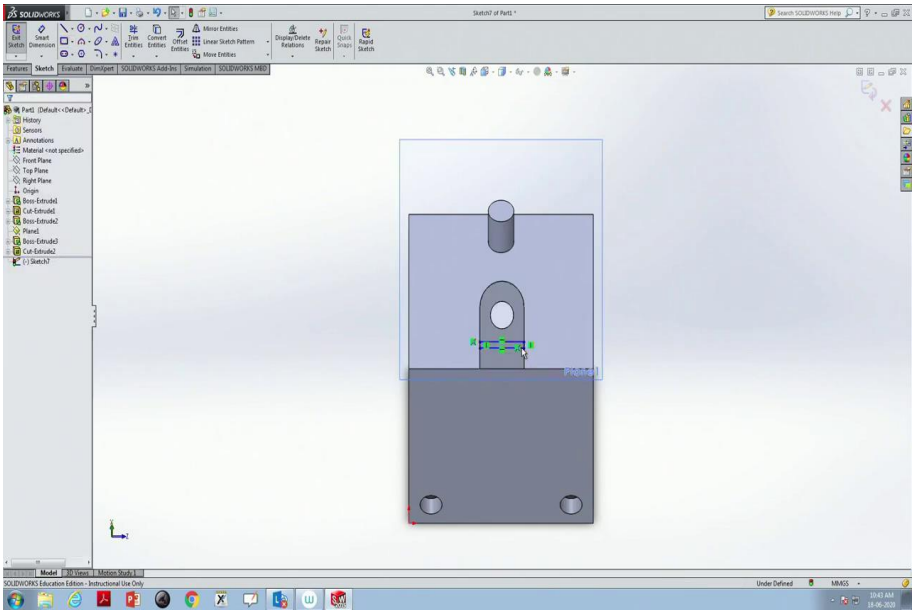
So, there is a hole which is passing through that entire object.

(Refer Slide Time: 12:55)



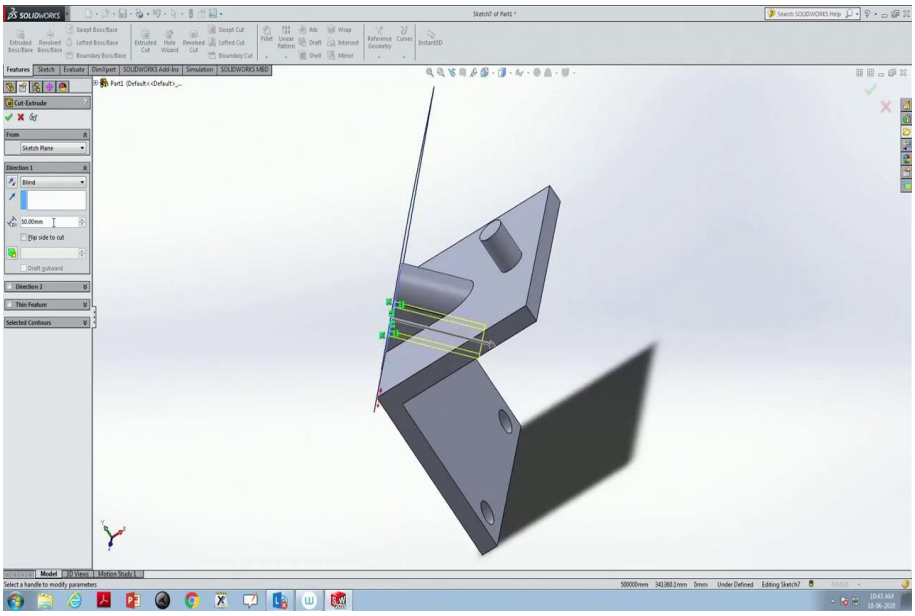
Now, we would like to have something like a slot on this portion, on this surface only. So, something like a rectangular slot, a small portion I would like to have. For that purpose, what I am going to do? Construct a rectangle, done.

(Refer Slide Time: 13:05)



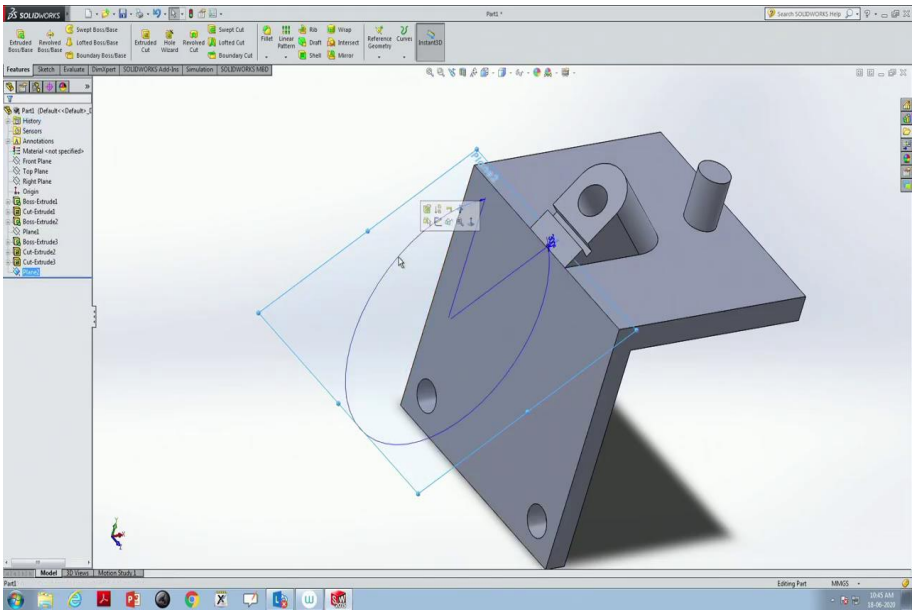
Now, this part is selected; we would like to have extrude cut, but some thickness not up to 50.

(Refer Slide Time: 13:21)



But something like 10 mm cut I would like to have, may be lower than that 5 mm. If you are seeing, there is something like a slot.

(Refer Slide Time: 13:33)



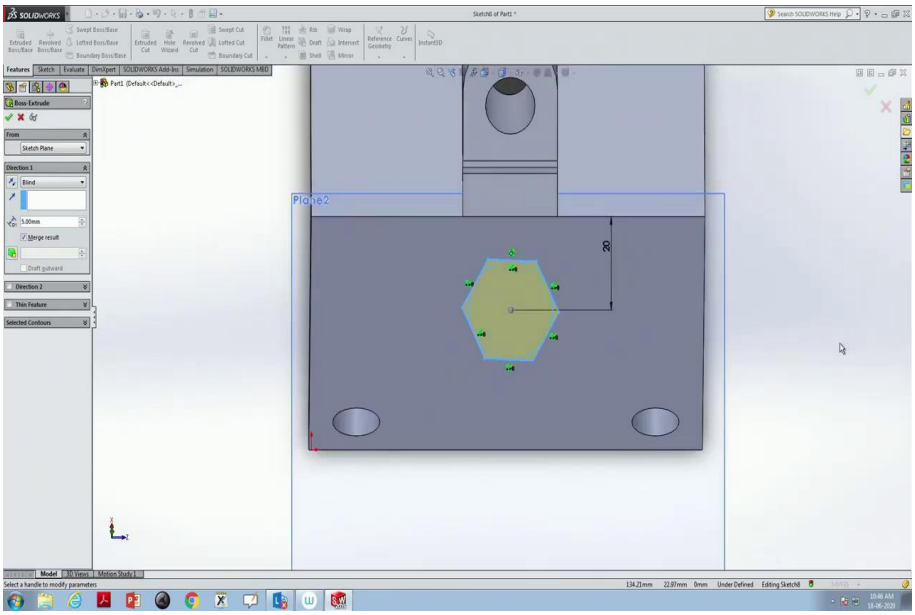
Now, I do not want to see this reference plane though it is there; I would like to hide it. So, for that purpose I have to click that; there is something like a spectacle, click that, reference plane will be hidden.

Now, on this surface I would like to construct another hexagon kind of thing inclined to pass through that; for that purpose, if I would like to construct a reference plane, what I have to do? First, select

this plane, go-to reference geometry; then with respect to this line, pick this surface, construct a reference plane.

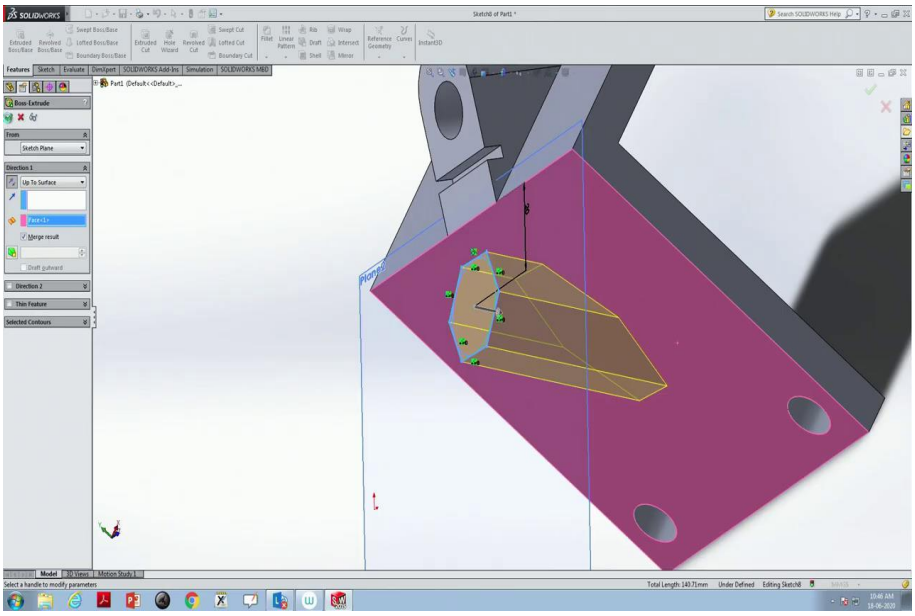
For the second reference click, click that; now change the angle, instead of 315 degrees, I would like to have some 300 degrees. Let us look at this. For example, you want to make a laptop, design a laptop; then this kind of reference planes always be helpful, let us click ok. So, once the reference plane is constructed; normal to that, I would like to have something like a sketch, a hexagon, done.

(Refer Slide Time: 14:59)



Now, I would like to use smart dimension, this point and this point supposed to be at 20 units of distance, done. Now, remove that circle, ok. Now, remove that circle oh its dimensions are there; click this, go to features, extrude boss base.

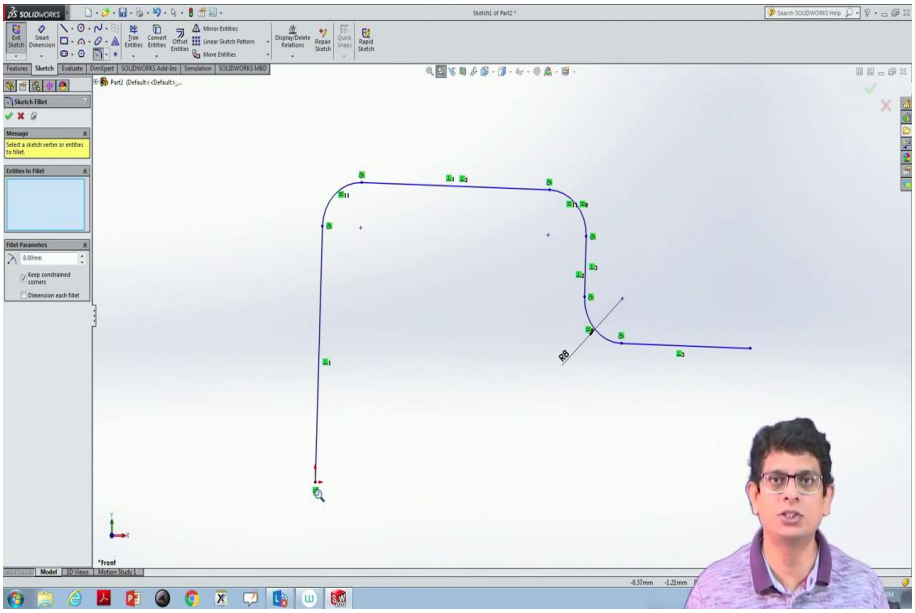
(Refer Slide Time: 15:51)



Up to which level we would like to have? Up to the surface level; so it is not blind up to the surface and the surface is this one and clicks ok. Let us zoom this portion.

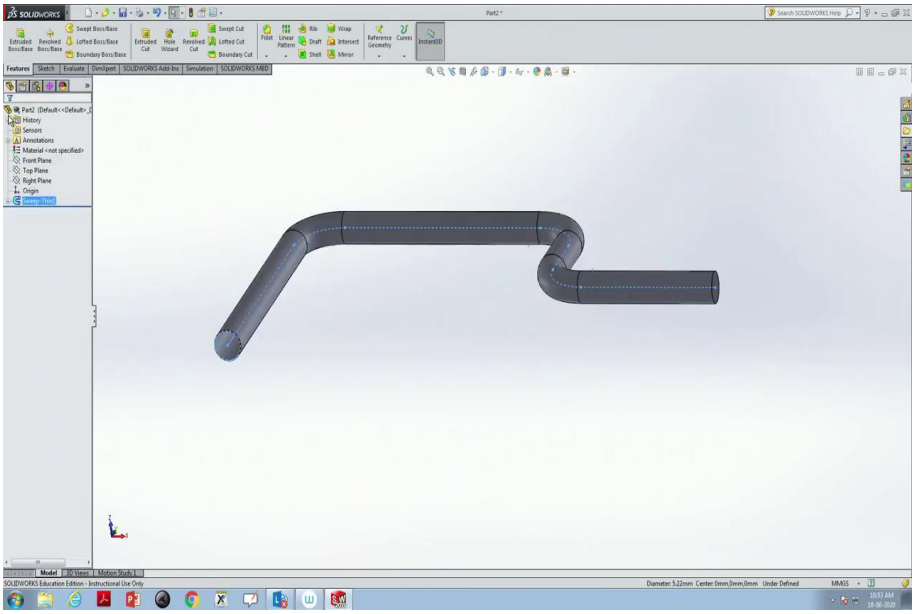
So, on different surfaces, if I would like to construct objects, this is the way we construct these objects. So, the first concepts are about constructing this reference plane. Now, using the same reference planes concept; we will be in a position to construct tubes, pipes and other kinds of mechanical objects. So, let us look at that also. So, again a new part, ok.

(Refer Slide Time: 16:51)



Now, go to the front plane, let us construct a line beginning with 0, a branching junction we would like to construct. So, now use sketch fillet, apply this, apply that; similarly apply that, apply this one, this one.And we do not want 5 mm, but 10 mm; but something like 8 mm we are interested in. So, then click ok. So, we have a curve. Now, if I am drawing a circle at one of the points, either at this point or at this point and revolve this entire object; I will be in a position to construct a pipeline, which is a branch joint.

(Refer Slide Time: 17:59)



So, we have to take that top plane; then make a circle of a certain radius, maybe 3 units, then click ok, now circle has been selected. Now, in that go to features, come out of sketch mode, click this object; there is an option in the features swept boss base, click that. So, this is the object and that object we are going to revolve around a certain axis or line. So, for that purpose, if you are looking here; the blue one is sketch 2, which we have highlighted as the circle. Now, click this magenta one and then click the line and then click ok. So, we will be in a position to construct that pipe network; here it is a solid object it is more like a bent. Now, if you want to construct something like a very thin portion; the way how to do that is cancelled, let us undo that, ok. So, first, select this circular portion, then go to this line, click this one; then there is an option like thin feature, change this 1 mm to 0.05 mm, then click ok. Now, if you are seeing very thin tube portion you will get. So, one way is constructing a solid one; the other one is by using this thin portion, we will be in a position to construct a metal sheet tube. In the next classes, we will learn about assembly things and how to make automation using this solid works.

Thank you very much.