Indian Institute of Technology Kanpur
National Programme on Technology Enhanced Learning (NPTEL)
Course Title
Engineering Graphics

Lecture – 09
Isometric Projections-Part-I

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Last class I have started dimensionings in orthographic projections. So completed few thumb rules or you can say that few principles in dimensioning, now arrangement of dimensions.

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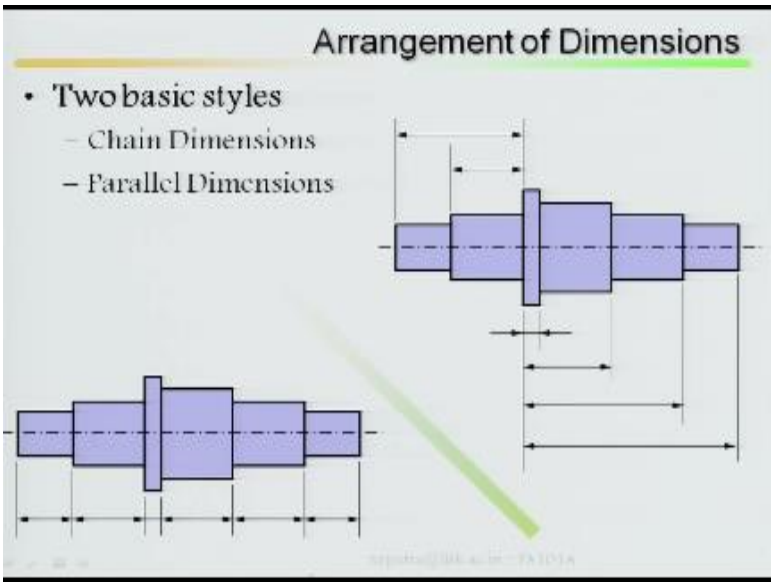

Two basic styles, chain dimensions and parallel dimensions, you can do in a chain dimensioning you can do in parallel.

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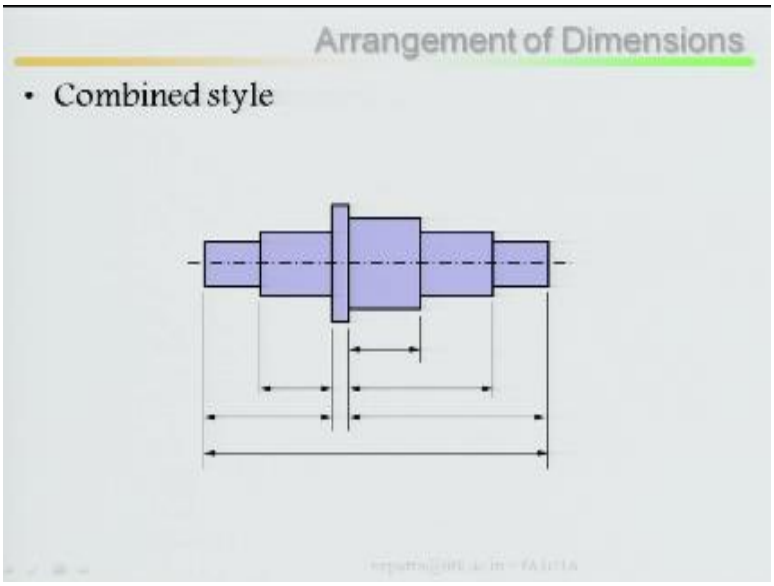

Also combined style also it is possible, in sport chain as well as parallel dimension you can do it.

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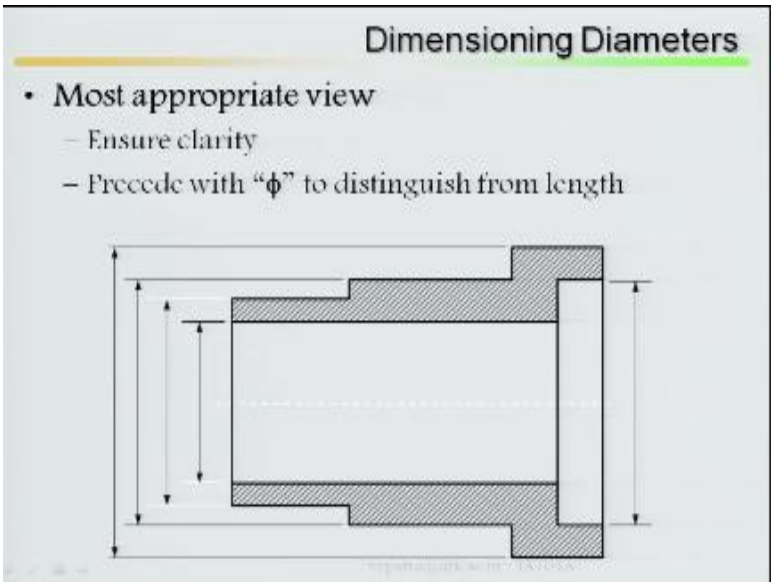

And most appropriate view ensure the clarity and precede with ϕ to distinguish from the length. So for this is the view, I have explained just review it, if this is a view that means this ϕ that means the drill diameter it should be precede with ϕ to distinguish from the length, that means it should be fast then your other length will be come forward. So here, here it is ϕ this is a drill up to this, then there is a ϕ this is of entered drill upto this, this ϕ. Φ is your nothing but a drill diameter.

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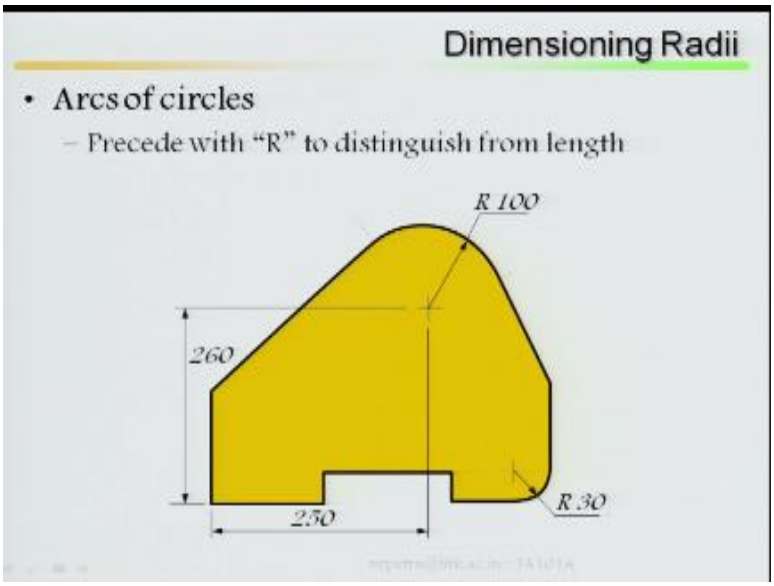

Then arc of circles precede with R to distinguish from the length, if you look at here this is your length that means this surface to this surface this is your length, that means this is your 250mm. This is one arc, this is another arc, that means from here from the center point I have taken a line from here R. 30, that means radius of this arc is your 30mm, as I said earlier the dimensions are in mm unless otherwise if it is not specified. Here similarly R =100 that means radius of this R is 100mm.

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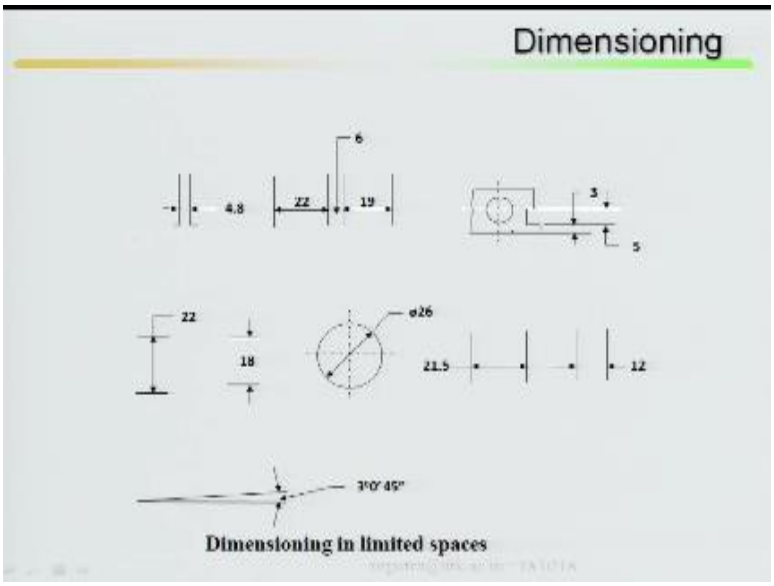

Dimensioning once there is no space is not available you can do this way smaller spacing's, here it is a dimensioning if a 3 degree, zero minute, 45 second, here it is very difficult to do dimensioning inside, here you can make it two arrows then from this arrow you mark it, here you write it three degree, zero minute, and 45 second that means dimensioning in limited space.

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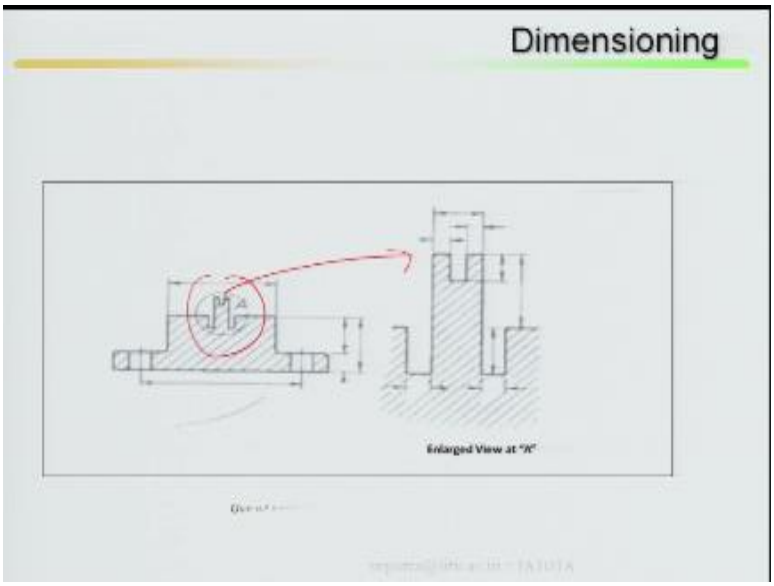

Enlarge view up to this I have covered enlarge view means if this is your view complete view, in this view this part you have to enlarge it because this is a complicated one then enlarge it and so the gap, so the depth dimension, so the width dimension inside this and what is this, you explain it, that means you mark it here, then take it here outside, enlarge it, enlarge or section AA and give dimensioning. So that it will be clear to the manufacture and he can easily read this dimensions of this view at A or section at A.

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Now start with this examples, few examples, two, three examples.

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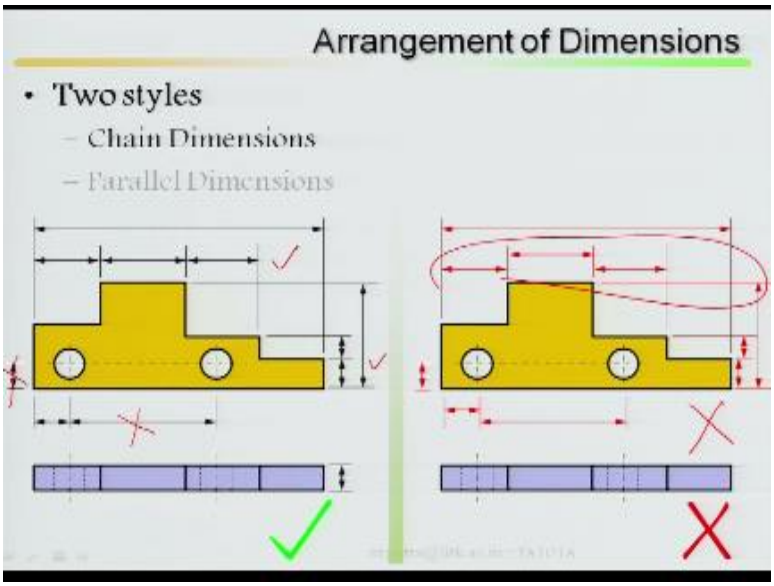

Two styles first one we are talking about chain dimensions, arrangement of dimensions, this is same view same view I am putting it here, look at here left hand side and right hand side. Once you start with the chain dimensioning that means if it starts here it will continue in the same line, if you look at here I am putting it here at the top for this dimensioning, putting at the bottom, here top, bottom, bottom, top, there is no alignment, no alignment.

Hence this dimension is wrong, this way of dimensioning the view is wrong, again another thing you can mark it, another thing as I said how you do the dimensioning, as far as possible do only two sides do not do all the sides, though I have marked it here as far as possible here it has been the dimensioning has been done this side, this side, that means as far as possible you removed this side and this side.

For clarity, cleanness a view has to be dimension only considering two sides. So comparing this same view this part of the dimensioning is correct because this chain dimensioning is consistent but here there is no chain dimensioning.

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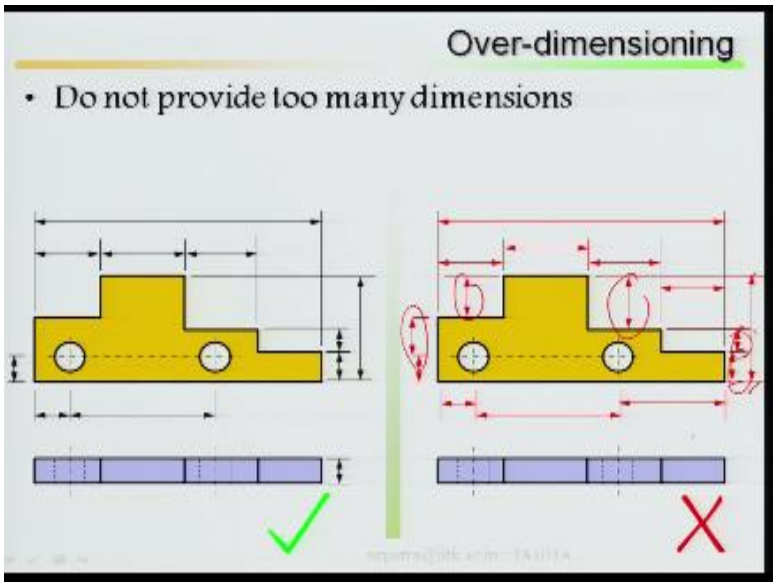

As I said there do not provide too many dimensions, as I said there one is your two sides second part is your do not provide too many dimensions, if you looked at here, here particularly in this case this side view here we are providing the dimension here, here, again here, again here, there are many dimensions are there.

It is obvious if I provide these two then easily if the total dimension if you know from here to here. If I provide this dimensions obviously I can calculate these dimensions instead of providing this dimension separately. So too many dimensions you avoid so in this way dimensioning particularly this view is wrong and this is correct.

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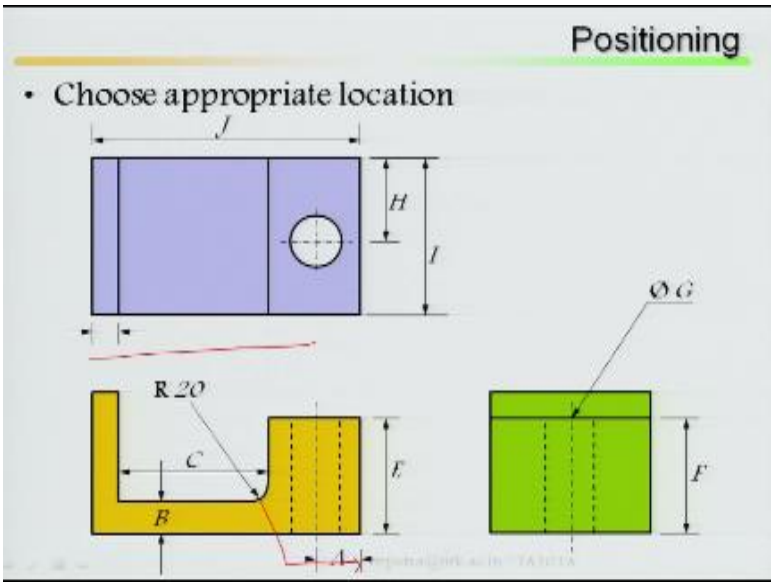

Choose appropriate location, positioning, dimension of the positioning you choose the appropriate locations, if you look at this appropriate locations that means suppose there is a this is a view there are three example 1, 2, 3 this is a view, if you looked at this view means this diameter this whole or this circle it is where it is this side, you can dimension from this side it will be better that means appropriate position.

I can do the dimensioning also from here to here, right? Appropriate position is the best one then, then here if you looked at here, here there is one arc, if you take arc from here this side and put it here I can also make it out outside I can put it here also this is correct, you cannot take it out here and show, it then here there is ϕ there is a drill, if you look at there is a hidden drill inside here.

Then in this view you can take from the center line, here it is a center line take it out ϕ = G, G is a dimension, it may be 20mm or 30mm. this is all about your course, orthographic projections and dimensioning.

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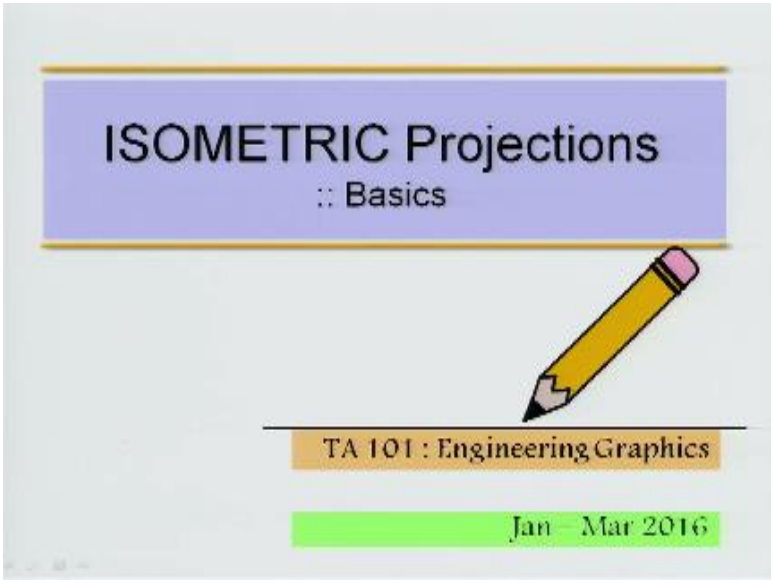

So next part I am going to start it isometric projections, isometric projections, second chapter.

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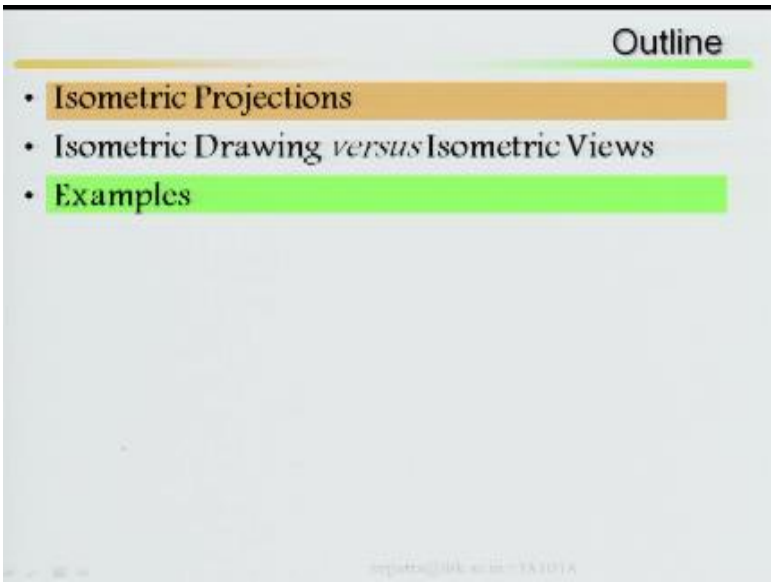

Then in this isometric projections outline basically we are going to discuss isometric projections, isometric drawing versus isometric views and few examples.

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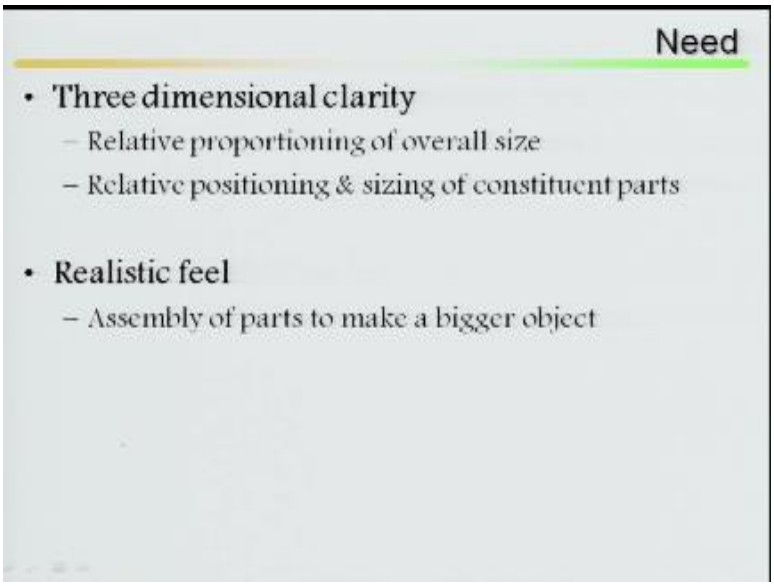

Three-dimensional clarity, relative positioning of overall size, relative positioning and sizing of constituent parts, what is the need? Need for isometric is, I can put this subject in such a way that. So that three-dimensional clarity will be there, I can see three-dimensional all sides I can see, I can rotate, I can put the object in such a way that I can see the front, I can see the side, I can see the rear view.

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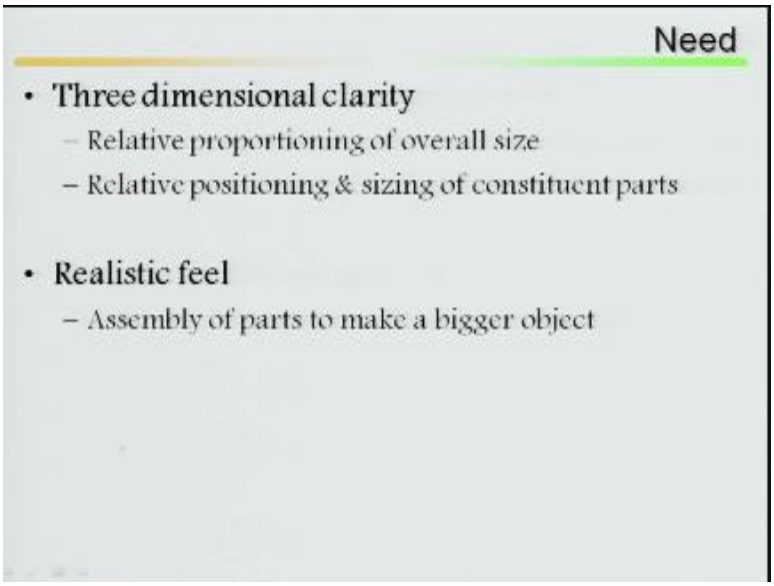

Realistic feel it is necessary isometric view to assemble parts, any scooter, any motor pump it has to be joined together, how to assemble? You can separate it out then looked at in a different position rotate it so that three dimensional view you can see it, then you can assemble this object. So that as a whole this manufacture can set it, this is the need for isometric projections as well as isometric view.

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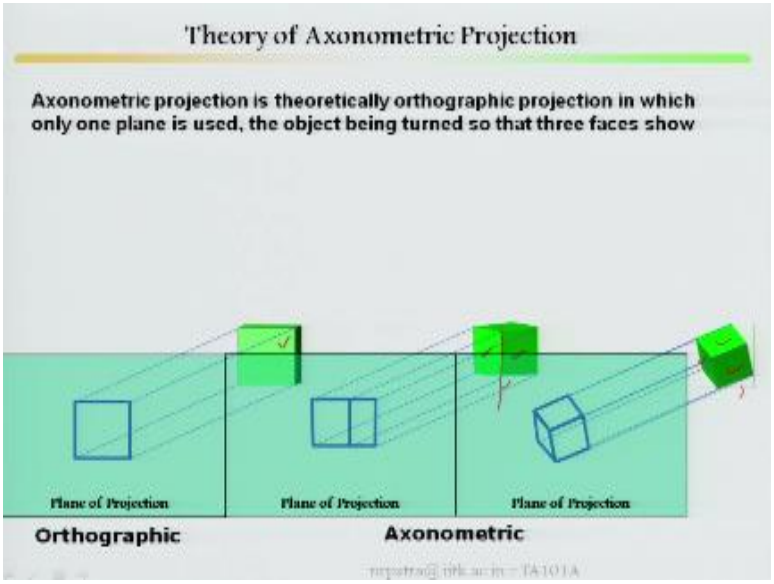

Theory of axonometric projection, what is axonometric projection? Looked at here very carefully, now this is a plane of projection, see there are two views one is this view front view is there in the front view, rear view is there, then there is, here there is a side view is there, this is a plane of projections I am seeing this projection on this plane, come to this, this object has been slightly rotated.

Look at this object, it has been slightly rotated, once it has been slightly rotated I can see this face, this face as well as top, side, front as well as some part of the top face I can visualize but here in this subject I can visualize most of the part of the front, side it is not clear and top it is not clear, now in this way if you look at the plane of projections how it looks I project it back, how it looks?

Here the moment I project it back the projection is only the face, here the moment I project it back face, side, as well as some part of your top surface. How it looks? Here it is front face but here it is the face which I am visualizing that means 3D view, three surface I am visualizing and it has been projected. Now again this there is a three distinguish try to understand.

This is simple object it has been viewed in the 11 side or one face, then same object has been rotated slightly with respect to vertical axis, with respect to vertical axis it has been rotated. Then here with respect to profile plane or side view it has been rotated, here it is rotated with respect to vertical axis, here it is rotated with this profile there is two difference with respect to vertical that means same object has been rotated with vertical.

Here same object has been rotated with your side profile plane, here it has been rotated with your profile, here it has been rotated with respect to your vertical axis. Now mark the difference, axonometric projection is theoretically orthographic projection in which only one plane is used the object being torn so that three faces. So it is basically you can say extension of orthographic projections.

Only difference is that, it has been rotated with respect to certain axis as well as certain view. So that I can visualize three faces, if you looked at here, here I can visualize only one face very clear and predominantly, here if you looked at I can predominantly see this view and as well as this view, some part of your top view top, top face not top view top face, here if you looked at I rotate it, I rotate it with respect to your side view.

With this axis it has been slightly tilted, then what happened? This face I can see, this face I can see, predominantly top surface also I can see it. Now plane of projection I bring back how the projection looks like, orthographic only one face, plane of projection I rotate with respect to vertical axis, I rotate it with respect to with respect to what?

With respect to your side view profile plane I rotate it. Then plane of projection how it comes look at here. So basically it is an extension of orthographic projection only object has been rotated. So that I can or object three faces can be easily viewed.

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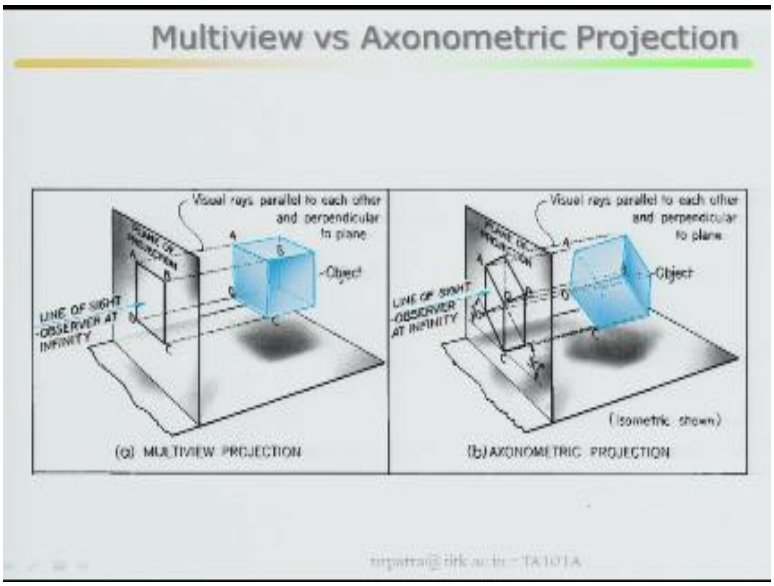

Multi view versus axonometric projections, if you look at here this is your multi view projections hence use line of sight here from infinity that means multiple means you are looking at here, then you are looking at here, then you are looking at here, then you are looking at here, that means front top as well as side but here you rotate it, you rotate it you are looking at here that means with a single rotations slightly rotating you can visualize three faces.

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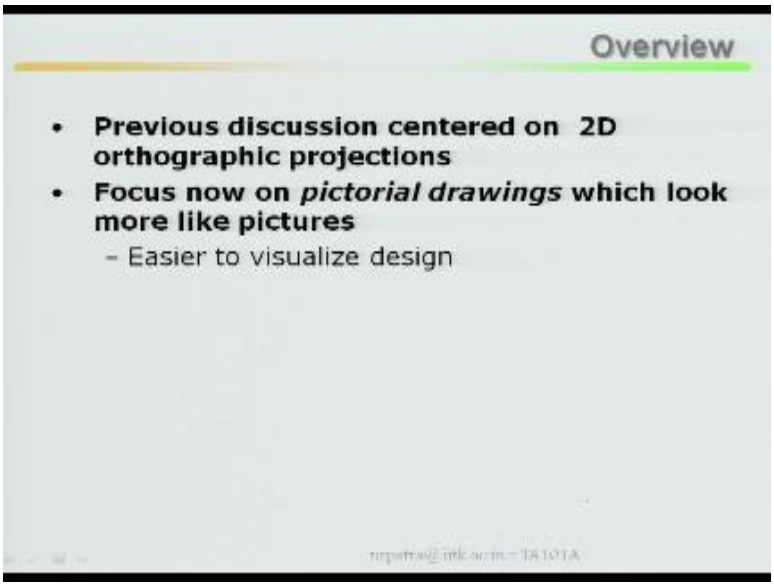

Previous discussion centered on 2D orthographic projections, focus now on pictorial drawing which look more like a picture or more like pictures it is a basically pictorial drawing, the pictures should be produced as a picture, pictures should not be produced as a front view, top view and side view, picture should be look like a picture should be produced. Easier to why, why the pictures should be produce like it is basically used in mechanical and as well as automobile and aerospace engineering.

Even in civil engineering also, easier to visualize the design, the moment you design it so that what did the front face, what is the middle, what is the side, what is the top side is there any notch, whether this notch is throughout or some part hole will be there is, is there any drill? The drill is throughout or part of the part, part of the view is only drilled, easier to visualize the design.

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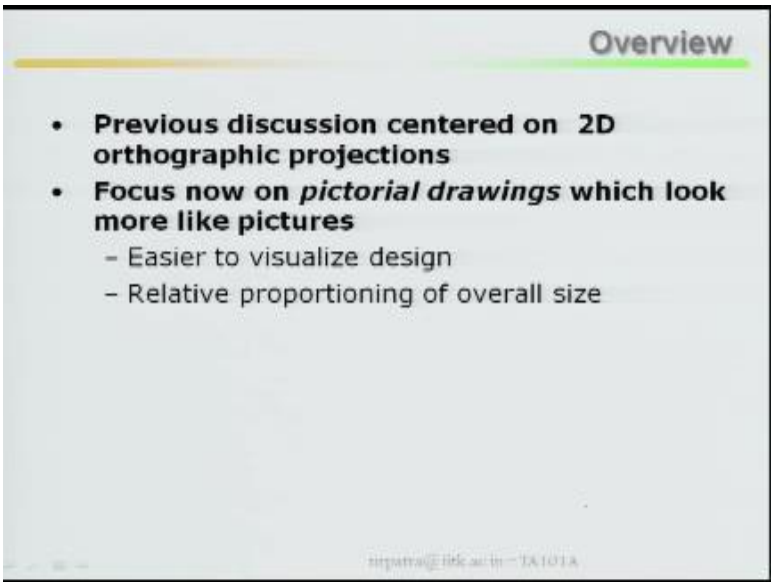

Relative proportioning of overall size, this is more important, most important is it is very easy to visualize how you proceed for design, then relative proportion of overall size, how it size is? Comparing the top, bottom, as well as side, how the size is varying, whether the size is consistent throughout or side is somewhere else it is not consistent or different size throughout the sections.

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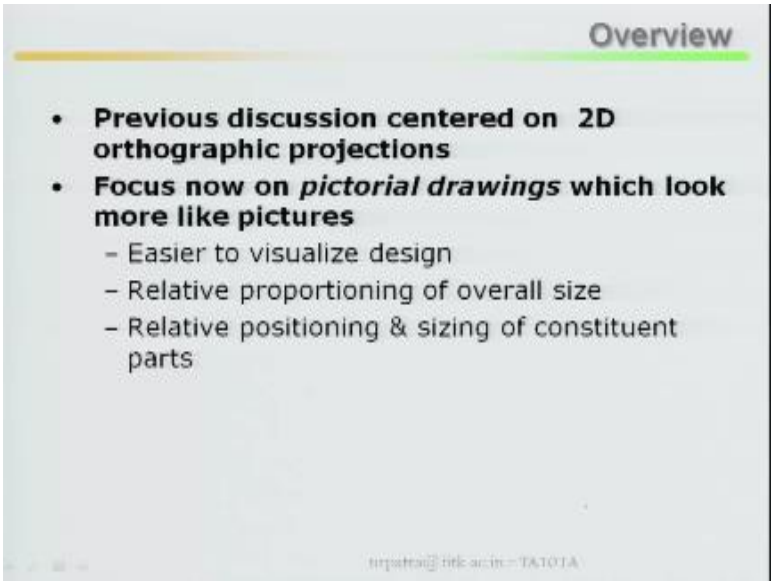

Relative positioning and sizing of constituent parts, different parts, if I take out different parts suppose if rotate it then I can see part 1, part 2, part 3 has been assembled then this, this different parts what is this constitute, what is their size?

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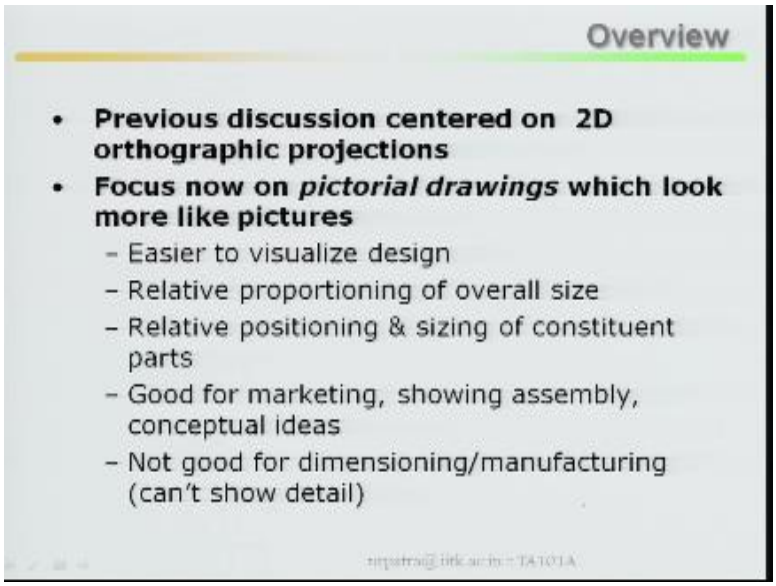

Good for marketing, showing assembly and basically conceptual ideas will be cleared, basic concept will be cleared in this view, not good for dimensioning or manufacturing, not good for dimensioning or manufacturing cannot show the details, cannot show the detail unless if you are not seeing front and top as well as back view you cannot show the details so not good for dimensioning, this is your overview of isometric projections and isometric views.

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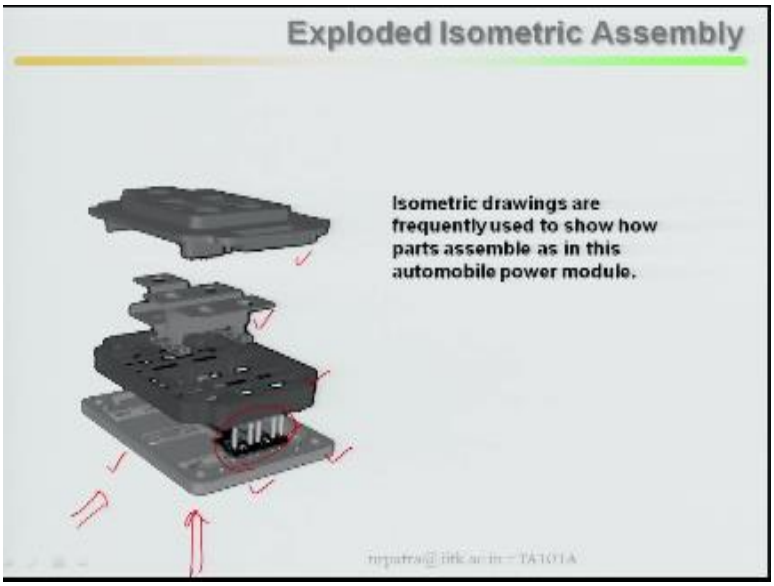

Isometric assembly, as I said simple example, there is a machine assembly, this is your part 1, this is your part2, this is your part3, part 4, part 5. I rotate it in such a way that my viewing direction is in this direction or maybe in this direction it does not matter, rotate it in such a way that standing it here or standing it here I can visualize this side, this side, how the assembly, this part what is its size, is there any hole, is there any notch?

Even if there is a nut and bolt, how the nut and bolt look likes? Even if there is holding how it looks like and top face will look like, isometric drawings are frequently used to show how parts are assembled are in this automobile power module, particularly not a mobile, how part has been assembled.

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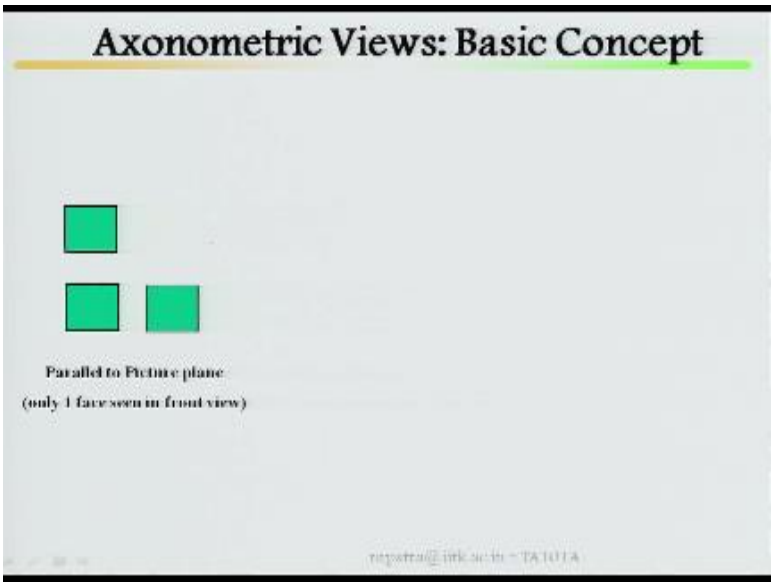

Axonometric views basic concept, look at this parallel to picture plane, what do you mean by parallel to picture plane? A picture plane is there, object is there, it is parallel to picture plane that means only that side, one face you can see, only one face you can see that is your front view.

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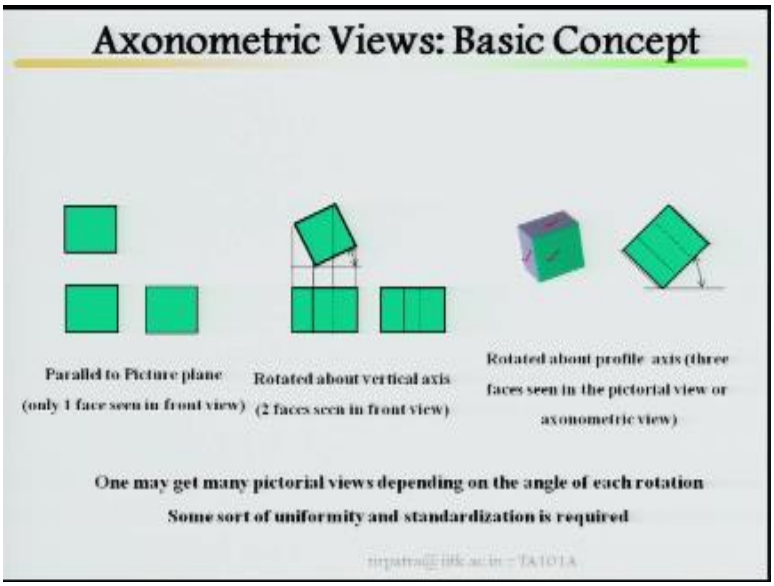

Rotate it about vertical axis as I explained before two slide, two slides before rotate it about vertical axis with respect to vertical axis it has been rotated. I can see two faces in the front view, parallel to picture plane only one face I can see in front view, rotate it about vertical axis I can see two faces in front view. Rotate it about profile axis as I said I can see three faces in pictorial view.

That is nothing but your axonometric view, rotate it about profile axis I can see three faces, here I can see two faces, here I can see one faces, this is your basic concept. One may get many pictorial views depending upon the angle of each rotation, try to understand, this I have not defined yet, depending upon angle of rotations one may get many pictorial views, here you are getting three face.

It may possible I can rotate so that I can get five faces also such a way that some sort of uniformity and standardization is required particularly axonometric views, let us see what is there.

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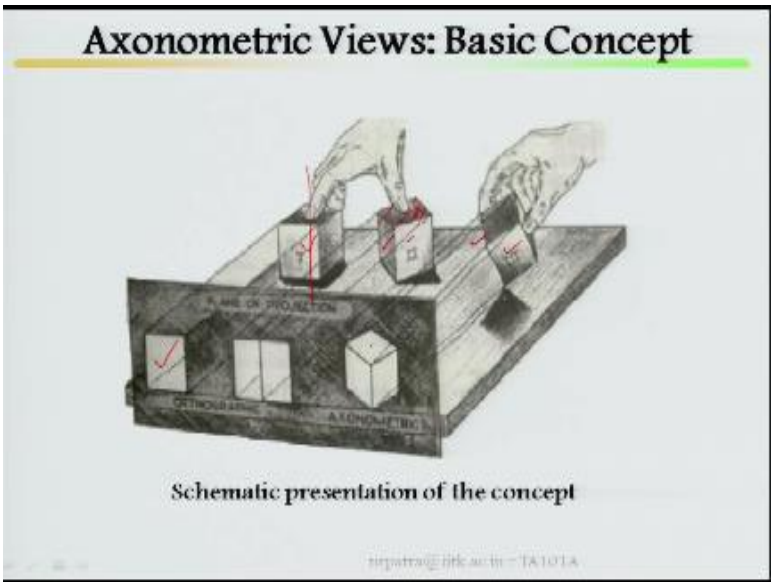

In a 3D picture, in a wooden plank 3D picture, this is your picture plane, you are viewing from here picture plane the picture has to be seen in the back side, object is placing here look at here, object is placing here a Q is placing here and parallel to picture plane, parallel to the this is your picture plane this subject is parallel to the picture plane, that means only this face I can see in the front view.

Front face I can see in the front view, it has been rotated with respect to vertical axis, vertical axis is nothing but what? This is your vertical axis, with respect to vertical axis it has been rotated, right? So then parallel to your picture plane, this is your picture plane this rays are parallel this view is parallel then there is a range, then you are getting this view and this view, why you are not getting this view?

This will merge, this will merge, will merge so you may not get this view. So you will get this view as well as this view, then rotate it with respect to profile axis slightly tilted, rotate it with respect to profile axis, this view you can see, this side you can see as well as top you can see, look at here, project it back, project it back, this is called axonometric view in 3D, I have shown it in a wooden plank wooden box with a picture plane and object.

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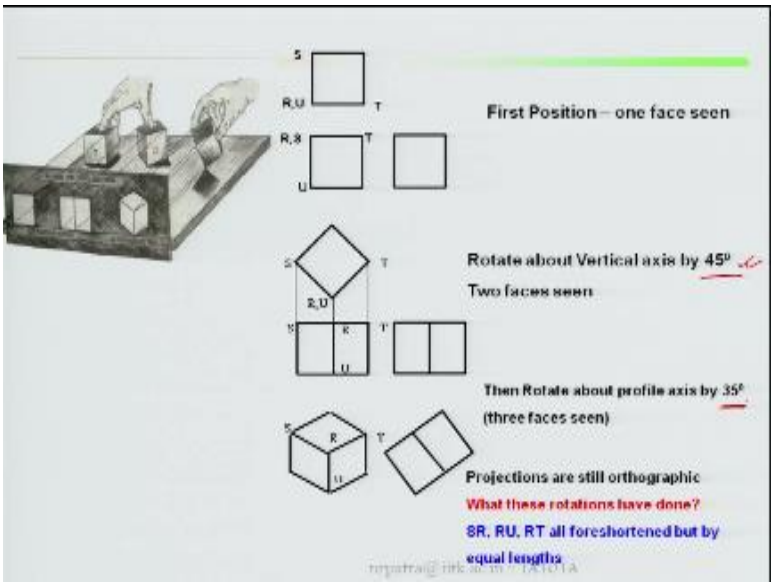

Just see it first position one face in first position one face in, rotate it about vertical axis by 45 degree, this is the standardization, I said you can rotate it at any angle, you can rotate it at any angle depending upon your angle this views will be different views will come. So rotate it about vertical axis by 45 degree. Now this is by 45 degree Q is there, rotate it about vertical axis because this vertical axis here it is rotated about your vertical axis 45 degree.

How your front view as well as side view looks like? It is there, the same Q it is SRUT how it looks here it is here, then rotate about profile axis, first it is there it has been rotated about vertical axis with the Q 45 degree then you see this two view, two faces then with respect to that rotate it about profile axis, the cube has been rotated then tilted about the profile axis by 35 degree, how this standardization come into picture?

Then you can see your three faces, this concept once you understand there will not be further problem for your axonometric or isometric views later on or isometric projections later. If you looked at here projections are still orthographic, what is your orthographic? Very first class I say, projection lines are parallel to, they are not merging at one point rather they are parallel.

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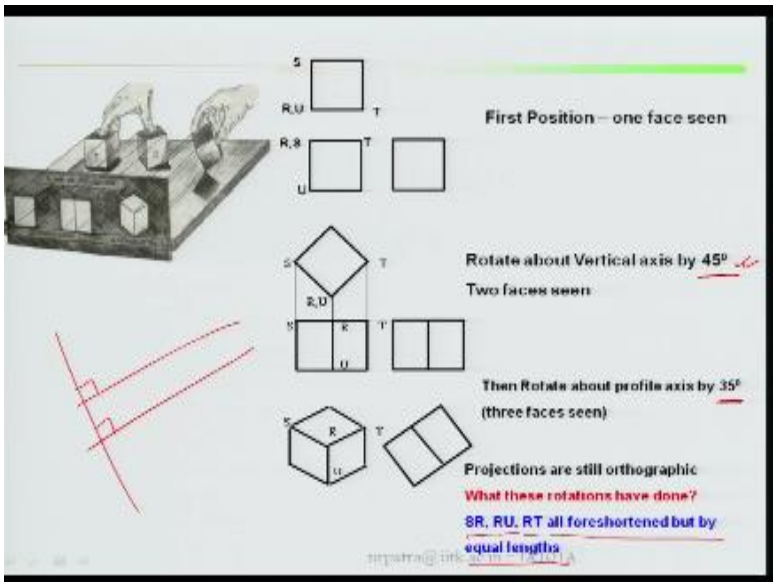

They are, here they are perpendicular with respect to this plane these projection lines are perpendicular, orthogonal with to this, that means still this three views are orthographic, what this rotation have done? If you looked at here rotation have done SR, RU, RT. SR, RU, RT this is your SR, RU with respect to vertical, then RT with respect to profile. All what additional you get it?

By doing this rotation at this here one face seen that means you will get the true length the moment this is parallel to this then that means what is this length? This length this is your true length. Now the moment you rotate it 45 degree then by rotate tilt it with 35 degree, all foreshortened but by equal lengths, if this angle is fixed what happen? If you take a different angle what will happen maybe foreshortened not appropriately equally.

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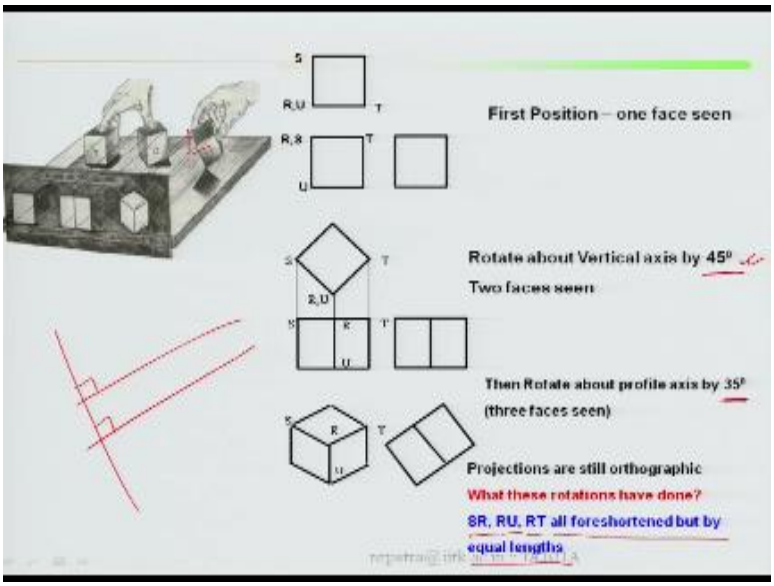

But here with this angle all will be foreshortened equal length, suppose this length, this length is foreshortened and this length is foreshortened it is equally, if it is by 0.5 it will be 0.5.

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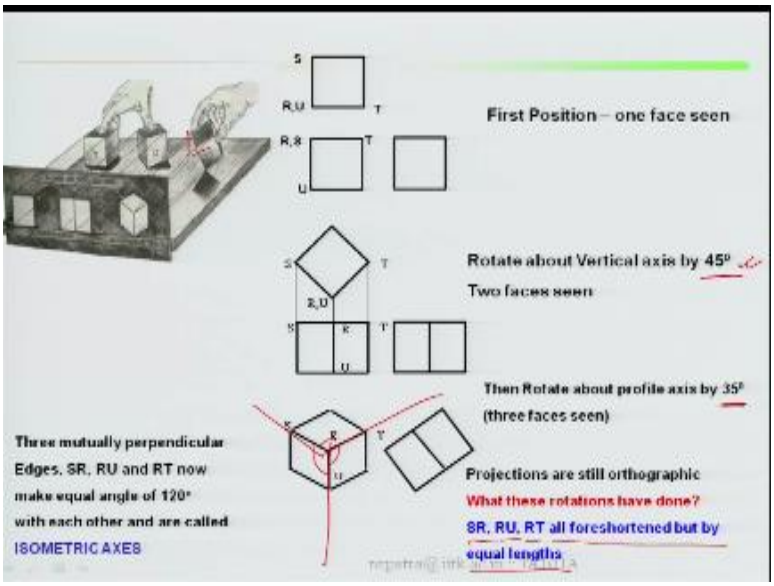

Three mutually perpendicular edges SR, RU and RT, if it is your RU that means RU is going down this your R, U is going down, RT this is your side SR. Now make equal angle of 120 degree with each other it is called Isometric axes. After doing this after rotating 45 degree then tilt it 35 degree SR, RU, RT. SR, RU, RT, these are making an angle of 120 degree, these are called isometric axes. These are called Isometric axes, this is your primary definition it starts makes an angle 120 degree, these are called isometric axes.

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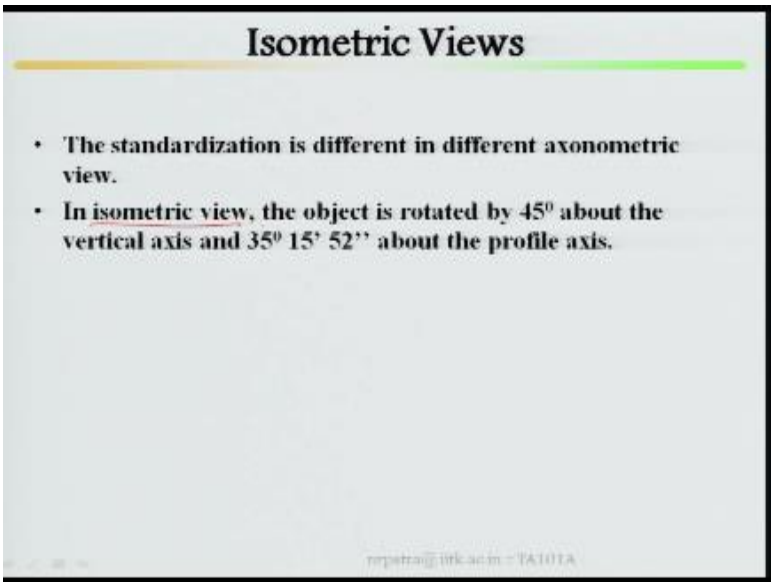

Isometric view, this standardization is different in different axonometric view, in isometric view the object is rotated by 45 degree about the vertical axis remember this standardization, in isometric view here it is not isometric projection, isometric view the object is rotated by 45 degree about the vertical axis, about the vertical axis it has been rotated by 45 degree, then 35 degree, 15 minute, 52 second about the profile axis.

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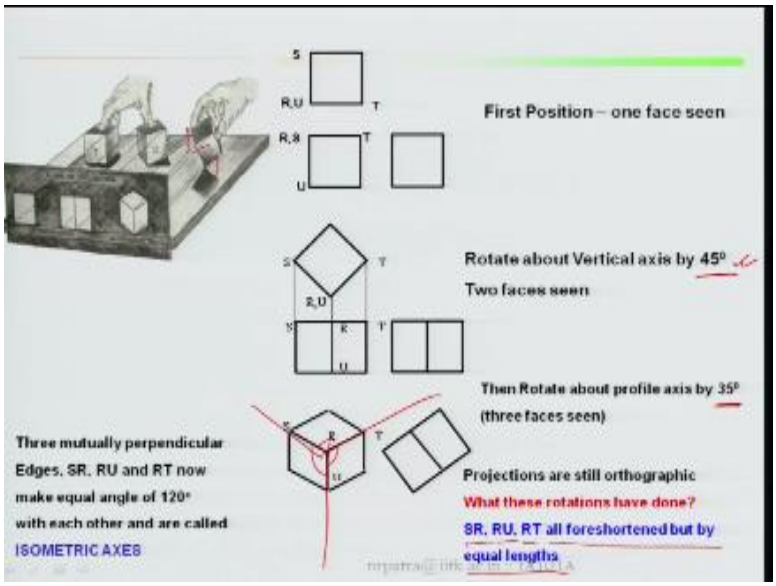

35 degree, 52 minute, 52 seconds about your profile axis and about the vertical axis it is 45 degree, why?

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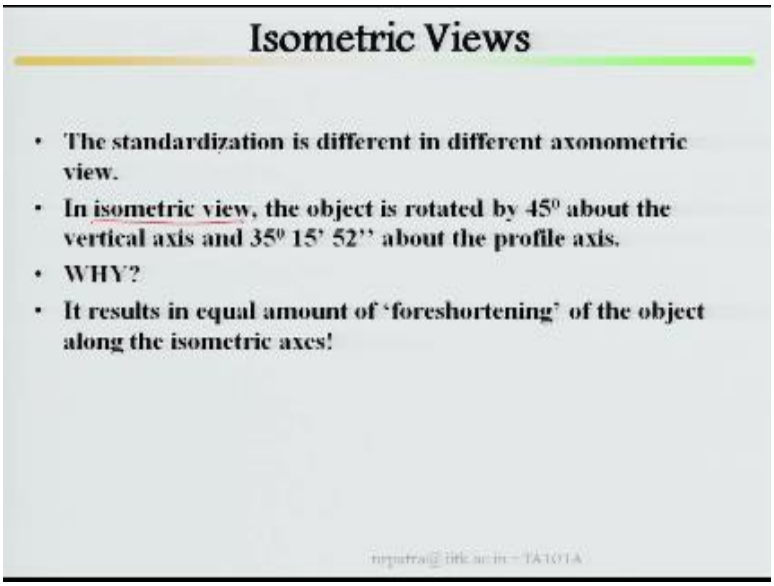

It results in why we were doing this? Because as I said earlier it has to be standardized.

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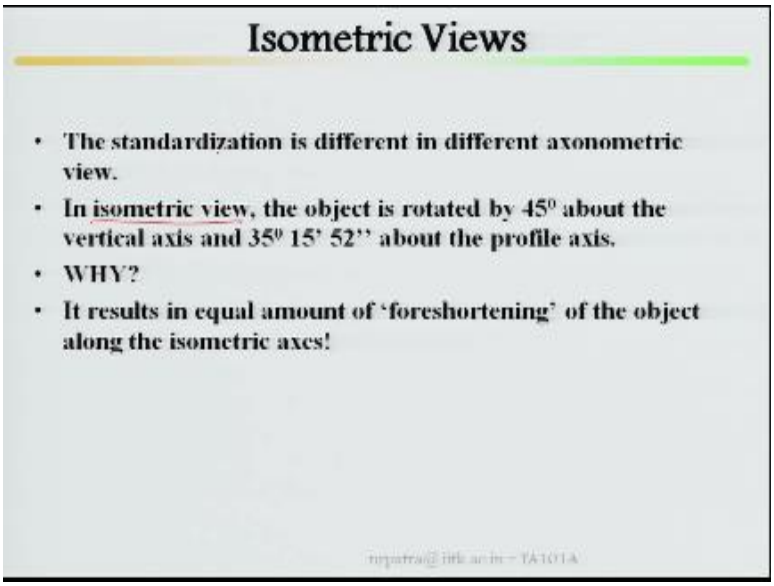

It results in equal amount of foreshortening of the object along the isometric axes.

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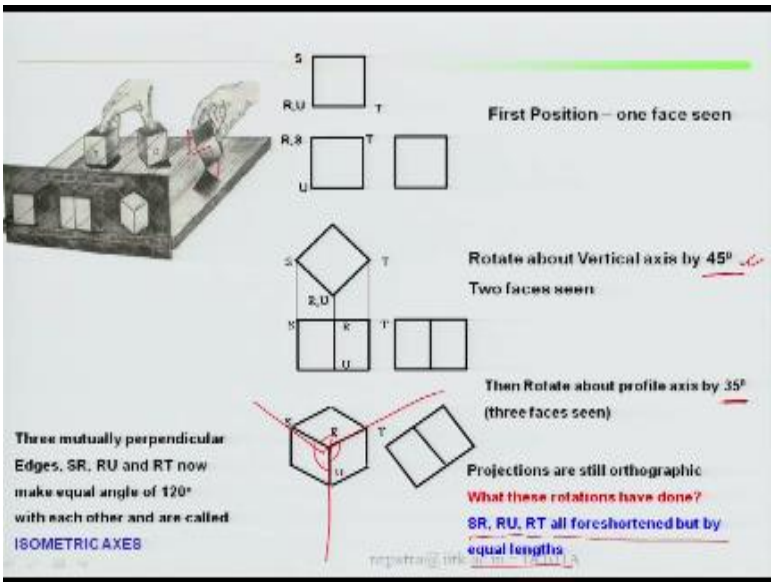

Isometric what are the isometric axes? SR, RU, RT this is your three isometric axes with respect to isometric axes it will be equally foreshortened, that means length, width, and depth that extends it will be equally foreshortened.

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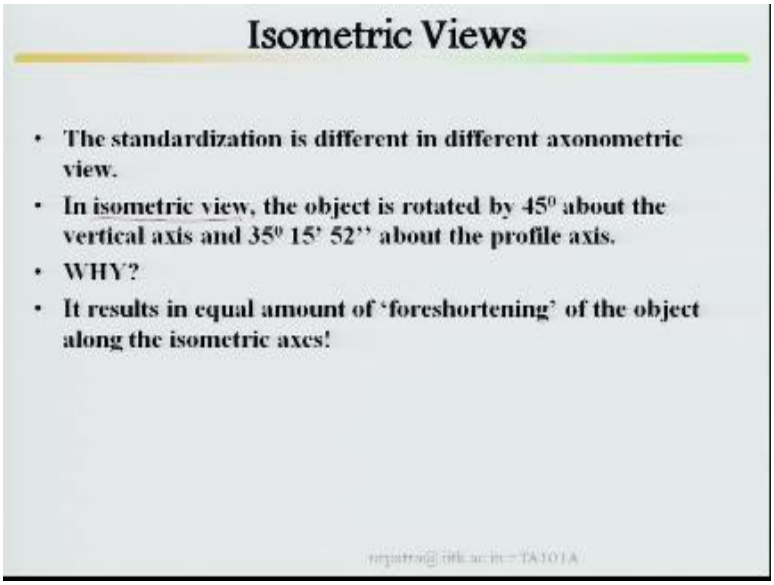

So it results in equal amount of foreshortening of object along the isometric axes. So in isometric view in summary the object is rotated by 45 degree about the vertical axis, 35 degree, 15 minutes, 52 second, about the profile axis and why? The answer is it results in equal amount of foreshortening of the object along the isometric axis. So tomorrow I will start concept of isometric projection isometric view, taking it into one object example as an example, I will stop it here, thank you.

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