Technical Arts 101
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Lecture - 12
Think And Analyze

I just imagine that I am a train that you are so desperate to catch after your mid sem exams to reach your respective destinations, where you come from somebody comes from Delhi, somebody comes from Bihar, somebody comes from the south who comes from south and lost. So, let me rephrase how many of you guys are able to catch your respective trains to your destinations on time who has missed a train to his or her house. So far nobody what is that? What is that? You have missed the train, once, twice, once from where to where

Student: Chennai to Vellore.

Chennai to Chennai to Vellore, anyhow forget about that?

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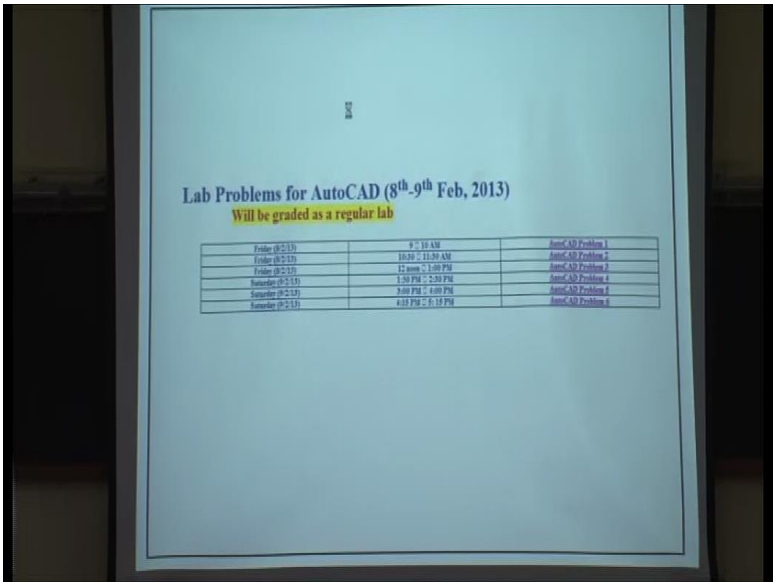

So, this Friday and this Friday and Saturday you are going to having your auto cad labs. So, the plan is the same as last time last week. So, two batches per session both on Friday and Saturday, forenoon sessions on Friday, afternoon sessions on Saturday. So, if you look at my if you go through my web page, I have chosen 6 problems 1, 2, 3, 4, 5, 6.

So, go through my web page you know which session you belong to click on the respective problem, prepare the sketch, this time you going to be getting only one hour to work on the autocad lab. So, prepare your sketch as well, make sure you understand the object very nicely very well, go to your respective autocad labs work on the object sum it the problem and get graded. So, Friday and Saturday we have autocad labs I won not be there, but two of students Mohit and Ramesh they will be there to help you out, and of course, collect your assignment sheets. So, was a little announcement

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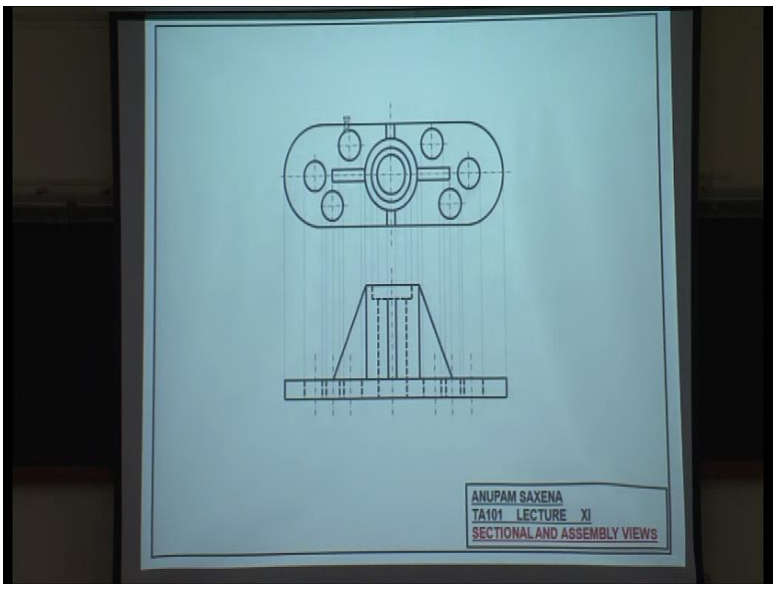

Let us get started. So, little recap. So, I started with this example last time last week and start with the top view and then do the front view and we both agreed we both agreed that the front view was quite congested it had too many hidden lines solid lines center lines and that was something that we wanted to avoid, and one of the options was to of course, section and object into two parts and look at the section and draw the front view. So, there were different options that we had explode last time.

The first one was the full section view you take a section you essentially divide the object into two halfs just throw one half off and look at the object with the section plane incident towards you, and then you draw the sectional front view which is a lot much clearer option. So, the first choice full section view the section second choice was the half section view you can use the symmetry of the object just take one quarter of the object out on the left hand side in this example you can choose to show the features as if

you are drawing the autographic view of the object full details hidden lines solid lines center lines the right hand side you can choose to show the sectioned view. So, you have clarity over here you have information over here half and half.

Option two full section view half section view, then you got offset offset section were you choose the section plane to pass through different features of the object in the top view and correspondingly section the object in the front view full section half section offset section revolved section.

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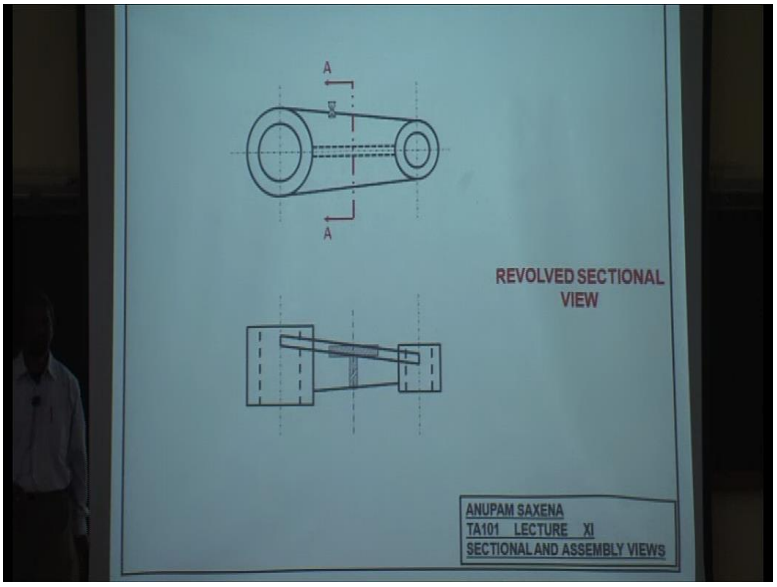

So, this is an option that you choose to show the cross section of an object cross section not the section of an object, but the cross section of an object at some chosen section plane chosen section plane cross section of an object revolve the cross section to show that on the front plane, fourth option.

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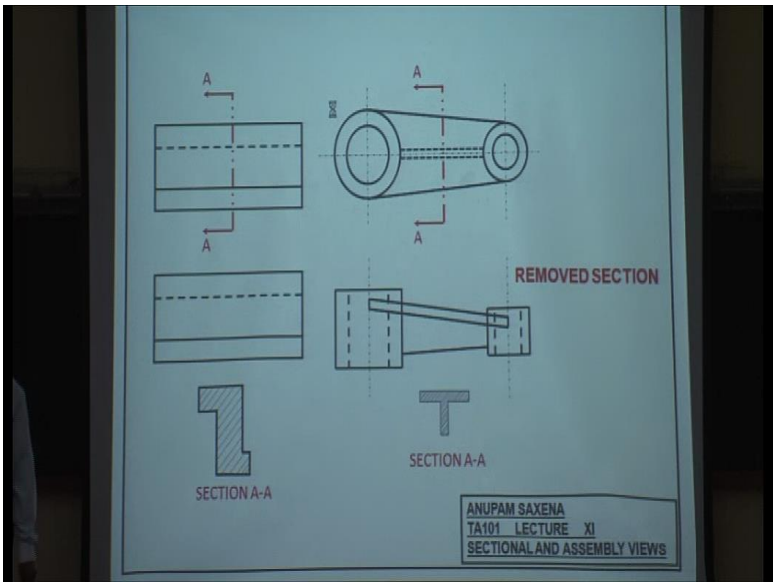

Fifth option removed section very similar to revolved section, you choose a section, and show the cross section of the object in the front view not with the front view, but maybe a little below or on the side, that is the only difference.

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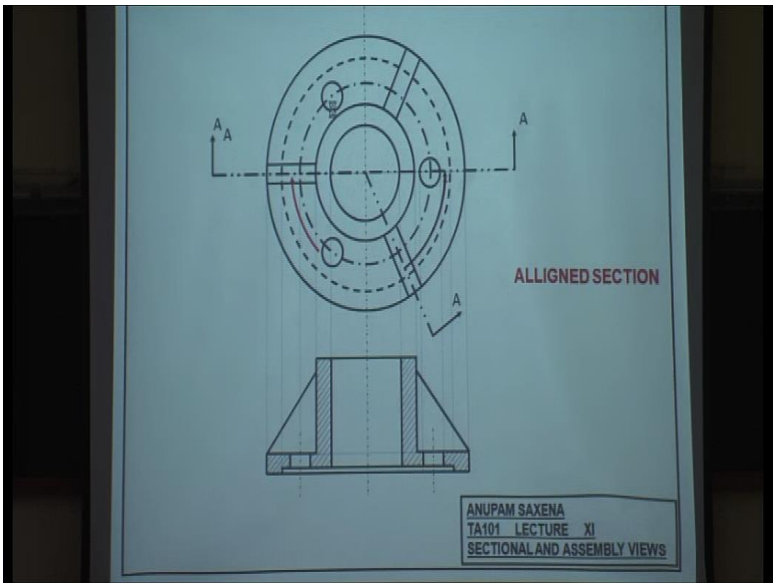

And of course aligned section. Here you tent to align different features with the section plane, and then show the section front view with two things in mind; number one clarity, number two dimensions. For example, Kevin last time said that you know if we did not align this thing along with this section plane, we could have taken the projection of this

rib over here that could not have shown the two dimensions of this rib in the front view, and that is the reason why we tent to go for aligned section in cases were or objects are not symmetric, just little recap we had seen this last time.

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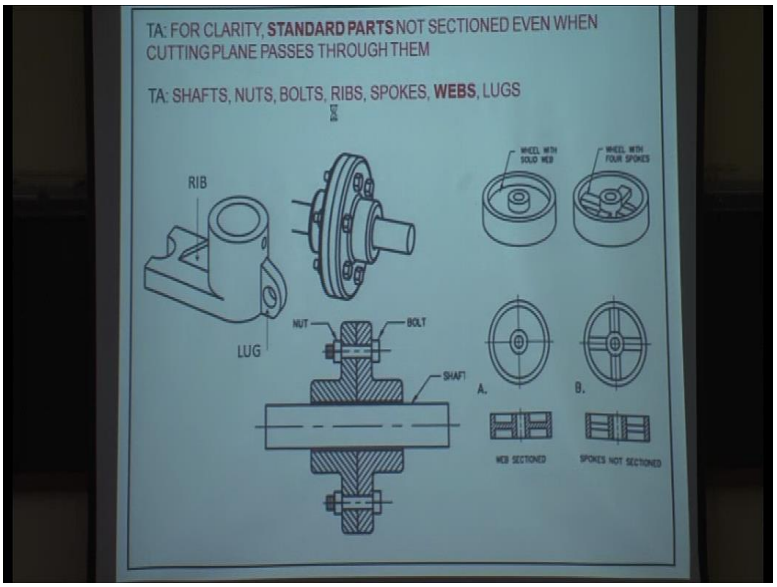

For clarity standard parts of course, they are not sectioned even when the cutting plane passes through them. So, some of those parts are shafts, nuts, bolts, ribs, spokes, webs are sectioned, lugs are not sectioned some examples that we have you have seen last time.

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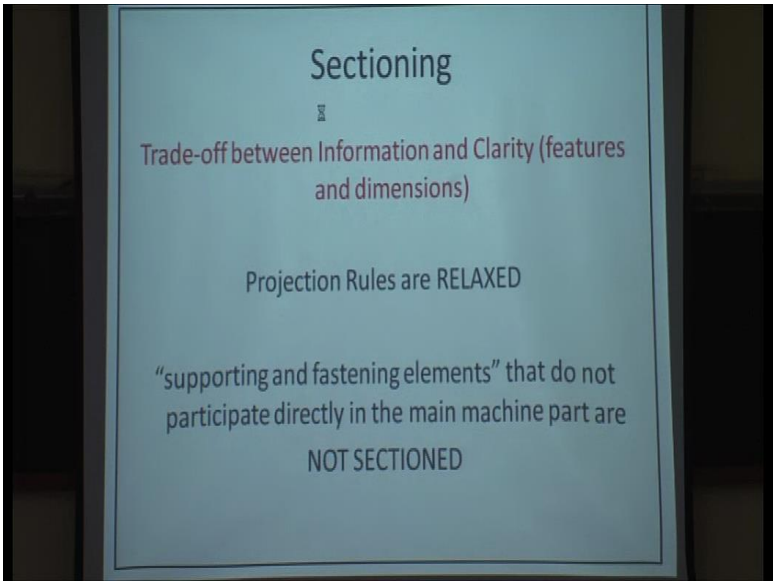

Bottom line sectioning potends to trade off between information and clarity, you have to choose what kind of information you wanna give and alongside you have also to choose how clear you want your section view to be. And these two terms information clarity potends to both features and dimensions. So, since you are working with sour speak autographic projections I mean section view is in a way autographic projection, you need to show two dimensions. Of course, rules of autographic projections are relaxed when we are working with sections, we do not have to diligently follow those rules.

Supporting and fastening elements that do not participate directly in the main machine part are not sectioned. Essentially I refer to these ribs, lugs, bolts, nuts, spokes, shafts these guys they are not sectioned, but then there is this big question.

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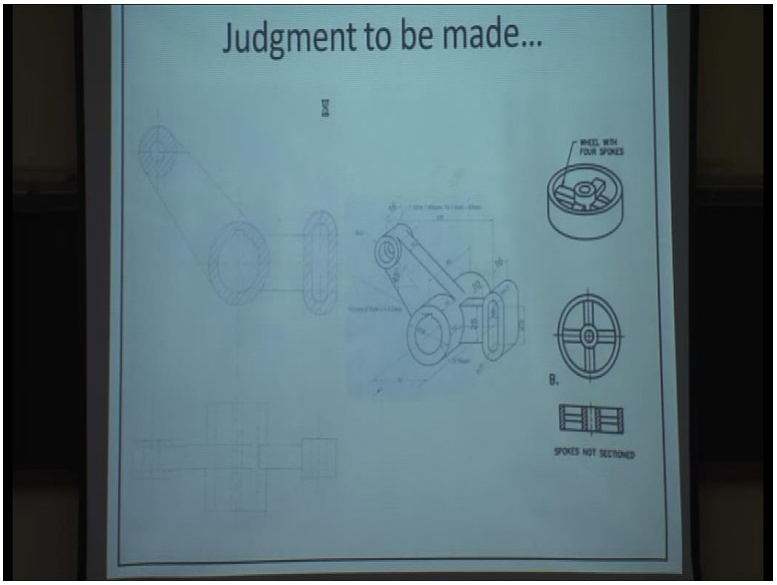

When do you decide what to section which part? I shall secret with you. So, this is a problem that was rejected as a missing problem for you guys. Question number four, but that is ok, I mean do not get any ideas that I am going to be asking you this problem, that is not gonna happen.

So, I choose this problem I start working on the solution this problem. So, you have a big cylindrical feature over here, a small cylindrical feature over here, and this feature on the right and these three features are connected by this guy here, and this guy here one look and the impression that you are going to be getting is that these two guys are what these

two guys somebody said ribs no clue. So, let me rephrase this question do these two parts participate in the main machine part are these important.

Student: yes sir.

Both of these. So, if take a section of this object from here till here, bottom two will IB sectioning these parts yes or no.

Stuedent: yes sir

Absolutely sure yes sir positively sure yes sir definitely sure yes sir these are not ribs no sir these are not ribs no sir fine I chose to represent them or I chose to depict them as ribs when I was working on solution for this. So, I did not section them I sectioned only the three main features the center cylindrical feature the top left cylindrical feature and this one I dint sectioned the two passing question, and we start we discussed this and one of my colleagues said well you know this does not seem right because they happen to be a part of the main machine parts they need to be sectioned. So, the entire thing is sectioned. So, there is no point asking you guys to work on this question because you going to be drawing the outer profile in the front view and you you going to be sectioning everything. So, the entire thing is going to be hatched I agreed with him. So, these guys they need to be sectioned, but you know you guys are smart very soon you will figure a loop hole in this rules I can foresee that and this is one of the things this one of the counter arguments that you guys you guys are Gonna be giving me.

How about pulleys or wheels with spokes are spokes not the main part of the pulley, because if you remove the spokes then the central part is hang in the air what do we do in that case should we section the spokes as well yes no.

Student: yes sir.

See you guys are divided who says yes long hands both hands who guys I mean hope you say no of course, the rest are you expecting me to give you the right answer.

Student: Yes sir.

I would not I will not. So, there are certain questions for which you need to find the answers for yourself and giving you two options either refer to your bible or ask god.

Bottom line is yeah sir there can be various whether a object is depend a lot. So, will you will you say that only this is the correct answer see the moment you say they can be very perceptions you are introducing subjectivity, but there is a subjectivity deciding whether a elements supporting or not absolutely. So, in this case yeah is there a correct answer for these type of questions or there can be various answers find the answer for yourself you know I told you something about what is right and what is wrong quite some time ago. So, find the answer for yourself.

So, in this case you make the judgment that these guys are not to be treated as ribs and therefore, they need to be sectioned why because they happened to be the main part they happen to be participating in the main machine part on the other hand these guys happen to be quite important to some not to all, but you choose not to section this spokes judgment is to be made, yeah sir all supporting elements no. So, ribs think about the ribs what do they do you remove them you still have the object intact fasteners they are essentially different components they are different from the main machine part right no. So, I am not talking about the assembly I am talking about the single part in the assembly a single part in the assembly I am not talking about entire of course, I mean if I remove the bolts and nuts from there the assembly is gonna get this fine, but I am talking about single part.

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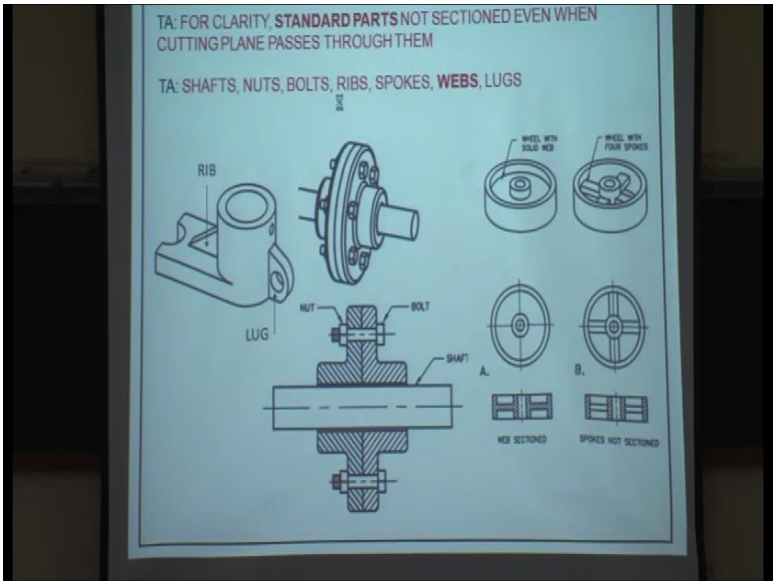

So, go back ask yourself this what is important and what is not ribs question ribs fasteners question fasteners spokes hubs question everything do a little bit of reading everybody little bit of reading follow the conventions and make a judgment try try to try to develop some some sense of judgment as to where you are going be sectioning what alright

So, the certain conventions that you need to follow and you need to be finding the answers to these yourself of course, I am I am I have I have actually giving you some help. So, if you have look that that p d f document more in sectioning will get something from there yeah there was a learning you are thinking think think a little more find the answer for yourself I am not going to be giving you the answer. So, do not cajole me, do not coax me I am I am not going be giving the answer I came here with my mind made I am not going to be giving an answer to this thing anyhow. So, keep working.

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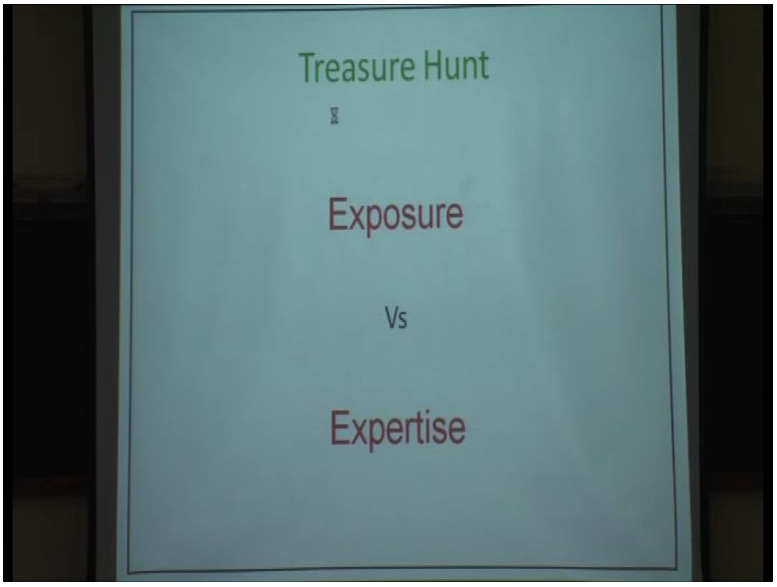

So, something that I want talk to you guys about you know you guys are in your second semester you still have six more semesters to go after this. So, it is a long marathon for you guys years the way I see and it was not long time ago that I was sitting along with you guys the way I see from both ends of the table that instructors help you guys prepare for treasure hunt, you know at the end of your eighth semester seventh semester you get something called a pay package pay package treasure.

Exposure verses expertise. So, we do not expect you to become experts at the b tech level this is when I say this I say this for myself I do not expect you to become experts after your B Tech. on the other hand I expect you to get exposed to a lot of subjects you guys are going to be doing six courses or semester starting of your second year.

So, we will expose you to a lot of subjects and experts you really very a lot. So, this what we do at the b tech level this what I do at the b tech level expose you guys it is up to you whether you would want to become an expert or not at the end of b tech if not not a problem definitely you have got something called the masters program definitely you have something called b p h d program were you learn to were you learn more about any subject of your choice. So, do not expect yourself to become experts of subjects after your b tech is totally fine no lot and it is for you not to know everything is perfectly right we give you hints we give you hints it is up to you how to use the hints for your treasure hunt alright I will talk about sectioning of assembly today.

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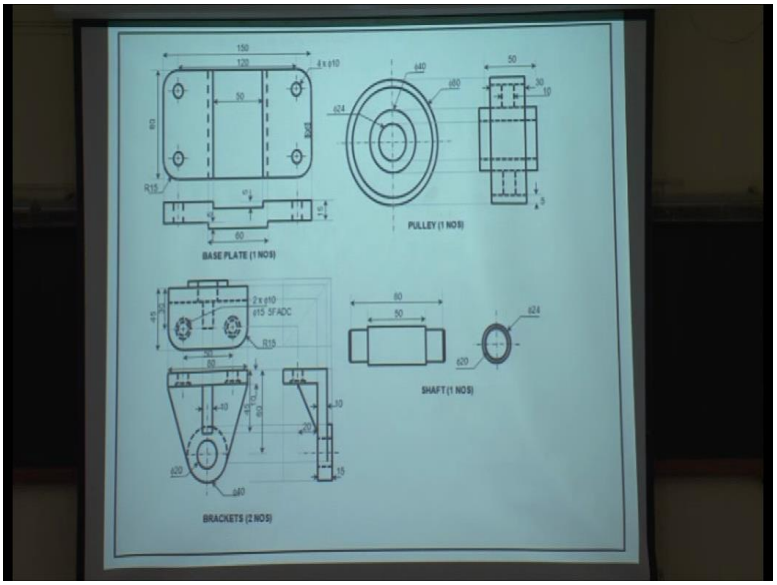

So, this the example that your 6.3 problem number 6.3 of your 6 lab this example potents that. So, feel free to make sketches if you want to. So, you got four parts base plate you got two brackets you got a pulley and you got shaft, once again you got a base plate, you got two brackets you got a pulley and a shaft you need to arrange them together into an assembly into a sensible assembly and show the sectioned front view full top view, and I am not sure, if I asked you to show the profile view, did I anybody having a manual, did

I ask you to show the profile view as well no just the full top view, and section view by the way in all the examples that we have seen today and the previous lecture which view did I sectioned was that always a front view or some examples top view some examples profile view just a front view what front only the front view on all examples yeah, why not top why not profile why only front why only front why not top why not profile priority ftp.

So, front view is the top most priority view then comes to top view then comes the profile view. So, you would wanna show as much details as possible with as much clarity as possible in the front view and then comes top view and then comes the profile view right.

So, by convention this my impression by convention the people attend to section front views mostly really have I seen somebody section the top view, and the profile view alright. So, these four parts base page you got dimensions 150 by 84 holes 4 arcs this little group here the something over here something over here where would the brackets go where would the brackets go here or here look at the dimension look at this dimension where would the brackets go. So, I will give you a hint the brackets will go over here one here the other one here. So, this guys gonna go just like that and if you flip this guy you come here between the two brackets you have a pulley which is supported by the shaft.

So, let me start drawing do you have any question. So, far any questions how I wish have could be sitting on there and dosing off yeah it is like a puzzle for you I have given you different parts you need to feed them together you got numbers you got the numbers dimensions what is the best way to assemble these guys together. So, that make sense study this problem when you working on your sketches.

So, I will start drawing I would want all eyes on the screen things are gonna get nice and messy at the same time. So, if you think about this all you need to do when you are drawing the sectioned view of the assembly is to just cut and paste the respective front views nicely cut and paste the respective front views.

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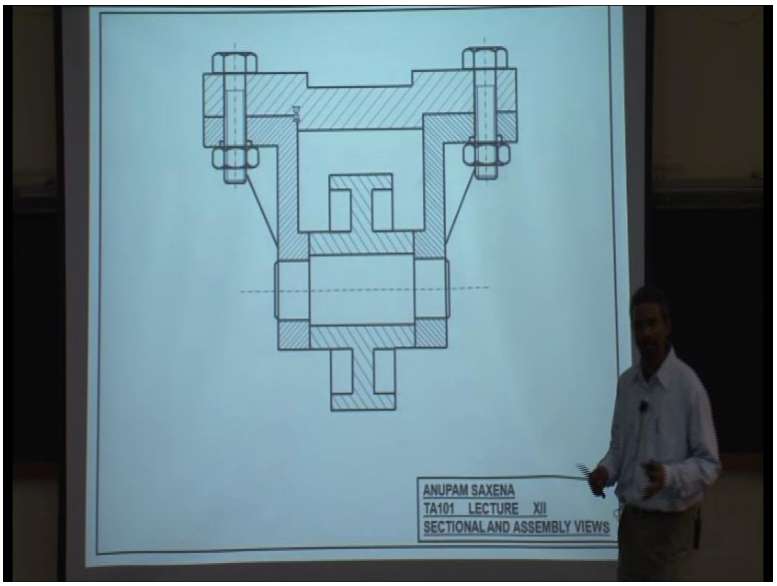

That's what I am doing the base plate do not worry about the dimensions, do not worry about the projections as yet yeah, base plate quite simple you got two cylindrical cylindrical voids, and then you got a bracket on the left a bracket on the right I am gonna go little slow got the ribs on the bracket center line two little holes in the bracket counter sunk or counter bow a cylindrical void to allow the shaft to go in on both sides the center line and I think your brackets are done you start working with the shaft. So, this is your shaft a little taper on both sides, and then you start drawing the pulley that is to be housed over the shaft.

So, I am little careful here I am not showing all the details that you actually see in the respective front views the certain lines which are going to be missing of course, because I have taken section plane and I have cut the entire assembly half and half good what this how it is. So, I got the base plate there I have got bracket one over here bracket two over here of left I got my shaft over here over edge I have got the pulley of course, everything is sectioned. So, many lines messy enough.

Student: yes sir.

Messy

Student: yes sir.

I the soccer guy laminal messy.

This were thing start getting beautiful wait and watch hatching lines or hatched lines at forty five degrees the distance between two hatched lined is almost uniform the brackets are sectioned differently the left bracket positive 45 degrees the right bracket negative 45 degrees or 135 degrees, you would want to avoid something like this in your diagram is to be perfect, and then you start hatching the base plate again 45 degrees, but with a larger spacing between the hatched lines the pulley again larger spacing minus 45 degrees messy, and beautiful yes, no. What is that why larger spacing, why larger spacing, these are four different components, these are four different components, they have to be shown using different hatched lines 45 degrees less spacing 45 degrees minus 45 degrees less spacing plus positive 45 degrees more spacing minus 45 degrees more spacing.

So, people attend to use you know thirty degree hatched lines 6 degree hatched lines at times. So, they are different dimensions that people to follow do reading its a different component its perfectly for you to want this to be positive 45 degrees want this to be negative 45 degrees all you need to show using hatched lines is that these are different components four different components the ribs are not hatched the shaft is not hatched and then I am going to be introducing fasteners a bolts they will not be hatched good enough they should be lighter then the solid line. So, maybe 2 h. So, this is where you can practice your art in technical drawing. So, make this as beautiful as you can

Student: sir.

So, as I said I mean people to follow different, different conventions. So, at times people to use hatching. So, that they are like two hatched lines which are very close to each other separate by a gap followed by two again closely placed hatched lines you can weigh the degree. So, I actually have chosen plus 45 and minus 45, but you can work with plus 30 minus 30 plus 60 minus 60 do not make them vertical because they get confused with the you get confused with the these lines do not make them horizontal does not make sense slightly slanted. So, the range is 30 to 45 45.

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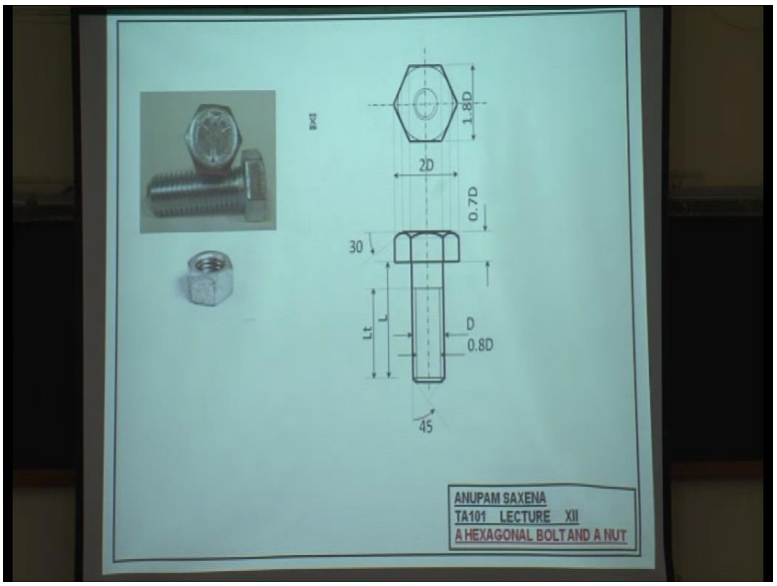

Alright nuts and bolts. So, people use different conventions, I am going to be introducing you to one of them, of course for the bolt you got the head which is hexagonal nature, you can actually have square heads also there are different kinds of bolts, and then the shank of the bolt you can have a part of that credit or you can have the entire shank credit and people. So, what people do is people say well, this is the hexagonal bolt with some normal diameter d. So, they would give you the diameter of the shank the outer diameter of the shank d, and you have to figure out well by convention the size of this bolt depends on d the minor diameter of the threads that also depends on d this guy here that depends on d, and I will show you how one of the conventions that people to follow.

So start with the top view. So, imagine that you are looking at the bolt from this direction in the top view start with a circle with one point eight times d, where d is the diameter of the shank draw hexagon lab one the vertex to vertex distance is two times d the face to face distance is one point eight times d, your top view is not yet over, but I have started with the front view take the projections, this distance here, this distance here is usually taken as zero point seven times d everything is with regard to or respect to the normal diameter of the shank.

This angle is 30 degrees draw horizontal. So, you get three points 1 2 3, 1 2 3, 1 2 3 with these three points in the respective regions rectangular regions draw three arcs. Now look at this guy here and try to compare this guy with this guy, what would this arc

correspond to what would this arc correspond to maybe essentially the projection of this arc over here. So, this nut is chamfered. So, will be projection of this arc this here would be projection of this arc and this arc will be the projection of this one here draw vertical lines draw the shank of the bolt diameter d. So, that measures the outer portion of the threads just follow this you would also be given the length of the bolt and the threaded length l t by convention. So, this angle is 45 degrees this angle is 45 degrees this a little caper down here, but convention we represent the threads by 2 solid lines and two thick solid lines and two thin solid lines and this distance between two thin solid lines is 0.8 d.

So, these guys they represent the outer portion of the threads, they represent the inner portions of thread this just one of the conventions that people follow they are many other conventions. So, those in you will be learning a lot more in 251 and 251, sir yeah this one in the top view in the top view of course, this is symmetric rather this is the axi symmetric look at the way I am representing the threads in the top view the nominal diameter thing is a dotted circle of diameter d that is the outer portion of the thread the inner portion of the thread is represented by three quarters of a circle it is a broken circle and they are dotted, because they are hidden of course, they are dotted, because they are hidden.

So, if you were to show the bottom view of the bolt in these two circles they would have been solid of course, there will be a bigger circle, nice or not no boring too many ratios to work with yeah this one diameter of this is d diameter of this is they should be they should be they should they should. So, what is your impression here boring nice too many numbers boring, boring, boring fine too many numbers yes sir how many of those who says it is boring are in mechanical engineering good luck with you 2 5 1.

Then you know I have the advantage of having a mike. So, I can reach you guys, but a people who are asking questions of yours asking questions to me, if you can lend a polite here to them not only will you be able to hear my answer if I am ready to give that you will also be able to hear the questions yes use of thirty degree its corresponds to the chamfered chamfered on the nut. So, chamfered on the head of the nut. So, see how this is made. So, it is not a regular hexagonal structure. So, there is there something some manufacturing operation that is happened on the head of the nut head of the nut through which these portions they have gotten smoothened in some sense.

Yeah, good question as far is the drawing is concerned as far as this convention is concerned pitch is not the information that we provide, but the only information that we provide with the nut is the nut has this normal diameter d through, which you get the other features the length of the shank the threaded length and the pitch or maybe pitch is also part of the convention right yeah, what this one this one what should be alright. So, did I ask you to draw the bolt also with your assembly view look at question about 6.3, did I yes or no no yes or no no sir no you guys are. So, lucky just in case just in case if I need to show the assembly the full section assembly along with the two bolts on the left and on the right oh by the way before I go there the nut is going to be something very similar to the head of the bolt just that this part will also appear over here. So, chamfering at both the ends of the nut.

So, this is how the final full sectioned assembly looks like I am a little curious I am little curious what was that for I mean are you trying to appreciate my drawing over here or what no anyhow yeah repeat your question please whole down whole down whole down can you be little louder sir you told fasteners. So, why do we need. So, much detail they are not important for what just two three minutes I will be done I am I am gonna say this or maybe not you doing five one or two five one or two, what is that is that a mechanics course or what yes sir mechanics guys come on, come on, come on, come on, I am not as exposed as you are come on come on.

So, if I talk about mechanics there something called a reference frame. So, whenever I make a statement I make a statement relative to some context. So, the statement that you gonna making well some politicians will say that I have been miss quoted. So, I have been miss quoted I am without politics. So, when I say they are not important I speak in relation to or with respect to sectioning. So, in sectioning I have to make a judgment as to which parts I need to section and which parts I do not need to section, because if I keep on sectioning everything then there is no point.

So, that is statement is in relation to sectioning of course, nuts and bolts are important right yeah then there must be something threaded inside that machine also. So, that it the side. So, why are we not the threading that the they represent both think about that they represent both its a set sorry sorry, sorry, sorry. So, this it is it is this threading that is important not not this one. So, this one the bolt is nicely able to get in. So, there is no threads there are no threads over here. So, there is some clearance the bolt is nicely able

to smoothly able to come in and then it gets fastened over here. So, sorry I missed of your question.

On the other side by a they were just been going inside yeah one thread is similar with other thread yeah. So, if you think about that then a look at look at this portion of drawing look at look at this portion of drawing. So, the nut and the bolt they both have interlocking threads thank you I was groping for that word they have interlocking threads. So, the solid line at the outer side and the thin solid line in the inner side they both represent the inner as well as the outer threads right think about that.

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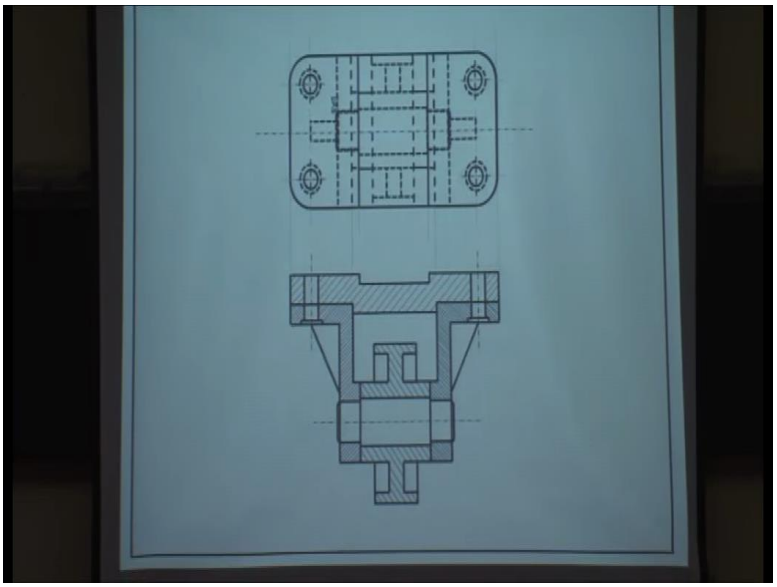

So, before I leave the floor if you draw the full assembly of this is how you are full sectional front view will look like, and that is how your top view will look like and just appreciate the clarity at the bottom and the complexity at the top clarity at the bottom complexity at the top two see words.