Fundamentals of Electrical Engineering
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Lecture – 31
First order circuits (Contd.)

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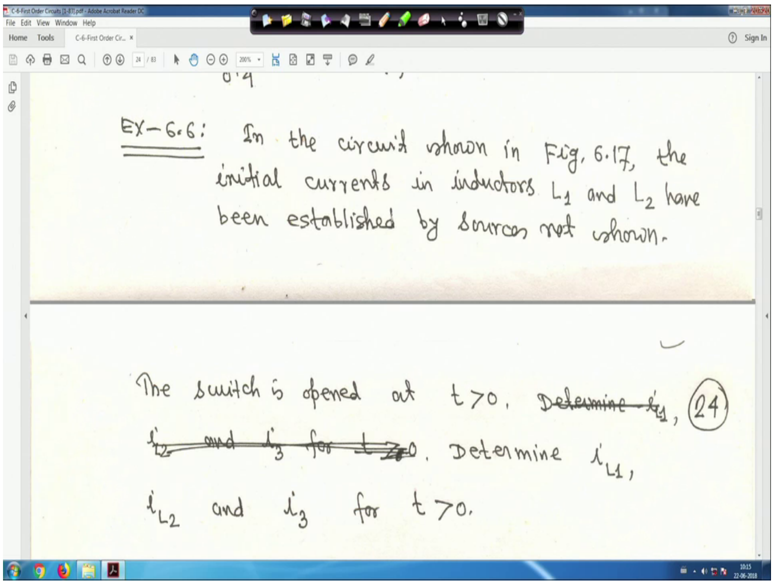

So, next is your in the circuit shown in figure 17, the initial currents in inductor L 1 and L 2 have been established by the sources not shown. You assume that there are some sources, circuit I will show you later. So, there are some sources and in initial your what you call currents in the inductors, 2 inductors are there in parallel and it has been established right. So, the switch is opened at t greater than 0 and determine I L1 I L2 and I L3, for t greater than 0.

The once for capacitor case RC circuit with 2 coil problem, where 2 capacitors were in series, but in this case a similar type of problem is taken when 2 inductors are in parallel. Here also, only one case, I will not tell you the reason, this is you to find out that you to try to think that why it has been taken right. And finally, if you have any difficulty you have the forum, there will there we are giving your all answers right. So but this I will leave up to you 1 or 2 things I will leave up to you. So, this is very interesting problem and just look at the circuit, right.

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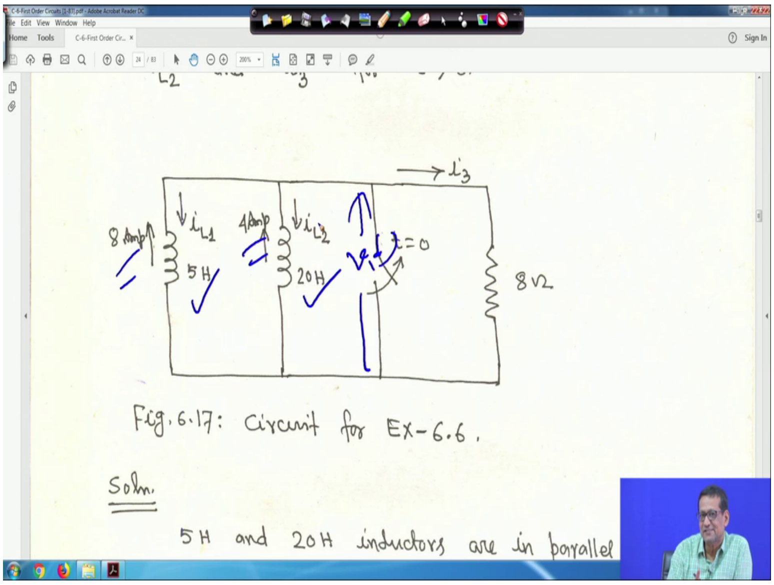

All the direction of the current i L1 i L2 and this is another i 3 is given right and your initial current through the inductor, it is given; 8 ampere and 4 ampere. This is also marked in that circuit, this is 8 ampere and this is 4 ampere. And this inductor is 5 Henry this is 20 Henry. And in problem it is said that in the circuit shown in this the initial currents L 1 and L 2 have been established by the sources right, not shown no need actually we assume that it was established. The switch is open at t greater than 0 right and you have to determine i L1 i L2 and i L3 for t greater than 0.

It is the i L1 t, i L2 t and i 3t for t greater than 0 and switch is opened at t greater than 0; that means, at this time switch has opened right. Now look at this, so 5 if you look into that this 5 Henry and 20 Henry are in parallel. So, it is like a resistor you have to find out equivalent, the way we have found out equivalent resistance there also you have to find out equivalent inductance.

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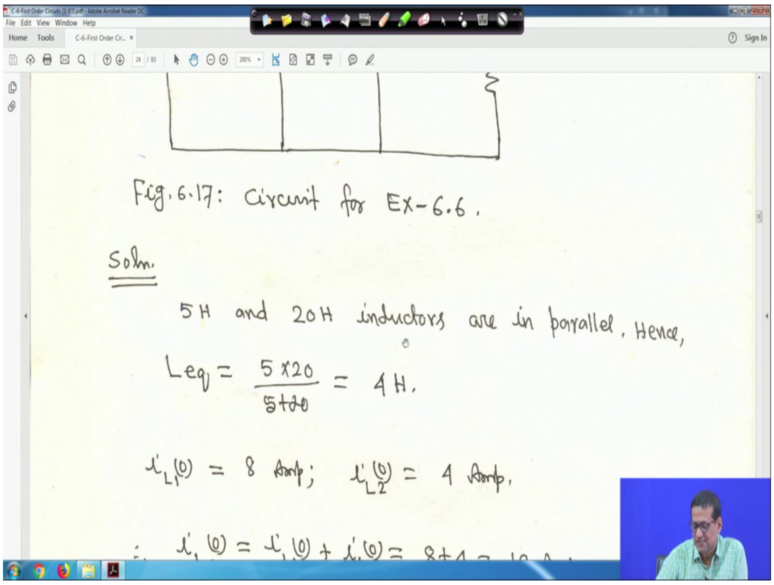

So, 5-ohm Henry and 20 Henry inductors are in parallel, therefore, L equivalent is equal to 4 Henry right. So, this is very simple. Now initial current that 8 ampere and your 4 ampere is given for inductor 1 and inductor 2 that is i L1 0 and i L2 0.

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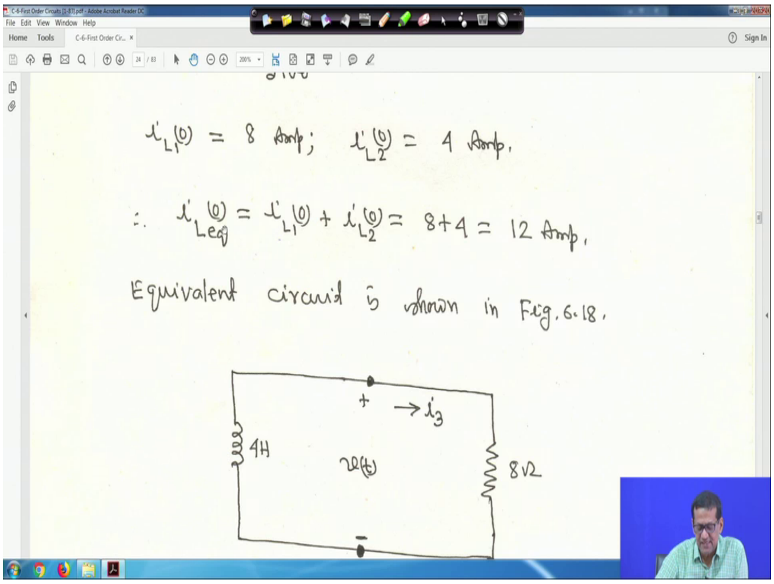

So, here it is i L1 0 is equal to 8 ampere and i L2 0 is equal to 4 ampere. Therefore, i Leq, equivalent inductor current will be i L1 0 plus i L2 that is 12 ampere right. So, this is actually units that is l L i Leq is equal to i L10 plus i L20; that is 8 plus 4 is equal to 12 ampere, both we are adding. So and equivalent your what you call inductance is 4 Henry, the parallel equivalent is 4 Henry and this is the voltage v t we have taken some point we have taken v t and this is the current i 3. If you look into that this is open as soon as you this is actually open.

As soon as you open it, these 2 parallel equivalent we have taken and this is the current i 3. So, and this is 8-ohm resistance. So, this is the equivalent circuit right.

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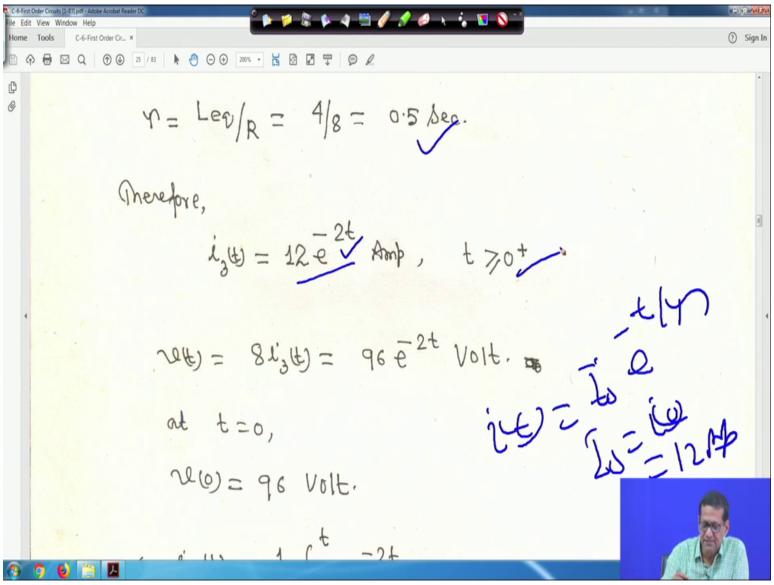

Now, in this case tau is equal to Leq upon R. So, your Leq is equal to 4 Henry and R is equal to 8 ohm. So, 4 by 8; so 0.5 second, so tau is equal to 0.5 second. Therefore, you know that i 3 generally we know i t is equal to i 0 to the power minus t upon tau. So, here also i 3 t is equal to initial current to initial this current that iLeq 0 is equal to 12 ampere right.

And your tau is equal to we got that is your somewhere I have mentioned that 0.5 second. So, basically we know this we know this one; this is for i 3, but in general we got know i t is equal to your i 0, say, capital I 0 or small i 0, so this thing your e to the power minus t upon tau right. So, in this case you are what you call that tau is equal to your 0.5 second that is why it is coming 2 t and this I 0 is equal to that combined inductors are that this thing your initial current is equal to 12 ampere.

That also we have made it 8 plus 4 is equal to 12. So, that is why it is 12 e to the power minus 2 t ampere right it is given t greater than 0 plus right. So, that therefore, voltage across the 8 ohm let me clear it. Therefore, the voltage across the 8-ohm resistance is v t is equal to i 3 t because this i 3 current is flowing through 8-ohm resistance that is given in the circuit. So, 8 into i 3 t if you multiply, it will be substitute i 3 t here substitute i 3 t here if you multiply it will be 96 e to the power minus 2 t volt.

So, at t is equal to 0 you put here at t is equal to 0, then v 0 will be 96 volt right, so that means, this one if you go to this circuit then initial voltage; that means, at t is equal to 0 this voltage will be 90 or 96 volt right.

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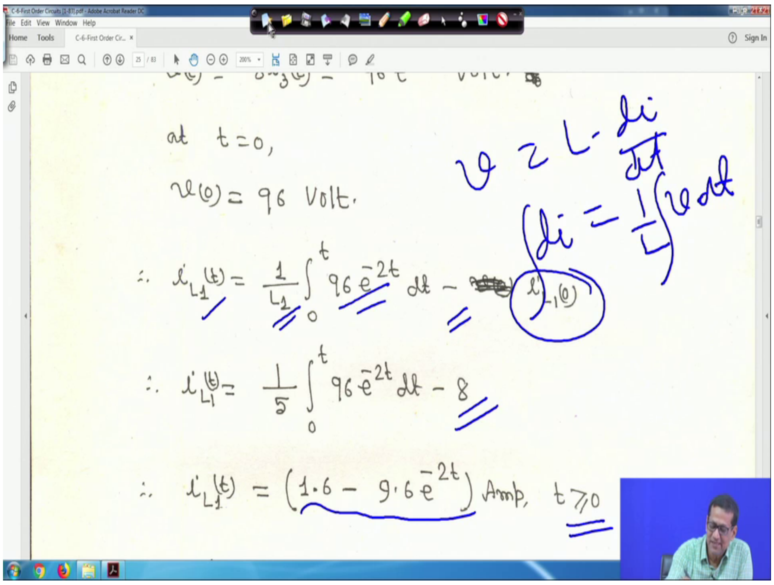

So, next one is that next is that when you are writing, that you are we know that your what you call that iL1 t right that is your v t is equal to in general v t is equal to L into d i upon d t.

Same for inductor1 and inductor 2 the parallel inductors 2 are there right. So, when you make it, I mean we know that in general v is equal to L into di by dt that we know right; that means, di is equal to your what you call your di is equal to 1 upon L right, then v into dt. If you integrate this like this, so, 1 upon L in general it is v dt. So this is my voltage v and this for inductor 1 and this is L1, this is everything is ok, but after this minus iL1 0 is there because initial current was there 4 ampere. So, why we have taken here the minus sign right? So minus or plus, this is a question to you right, L same as capacitor I put this question. So, hope when you will go through this video lecture right.

So, this 1 or 2 things I am leaving up to you just to see whether you can answer correctly or not you just put the answer in the forum. At that time, we will see it otherwise, I will answer immediately do not worry do not worry, but just leaving up to you just have some thinking; everything, we are trying to tell everything from my side I am trying my best to tell everything, but this is 1 or 2 I am leaving it to you that just think right.

Similarly, your what you call and if you integrate and if you put this value this 8 ampere right, i L108 ampere, so it is coming actually your 1.6 minus 9.6 e to the power minus 2 t ampere, this is for t greater than or equal to 0 right. Next similarly, the same question was there for when 2 capacitors were in series right.

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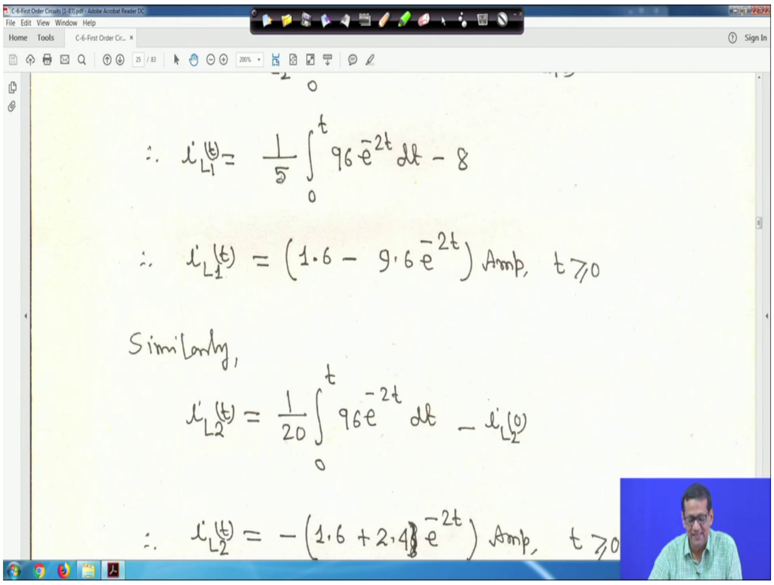

Similarly, i L2 also here it was 5 Henry L 1 was 5 Henry, here it is 20 Henry and it is 0 to t 96 e to the power minus 2 t dt; so, minus i L2 0 right, so here also minus sign is there.

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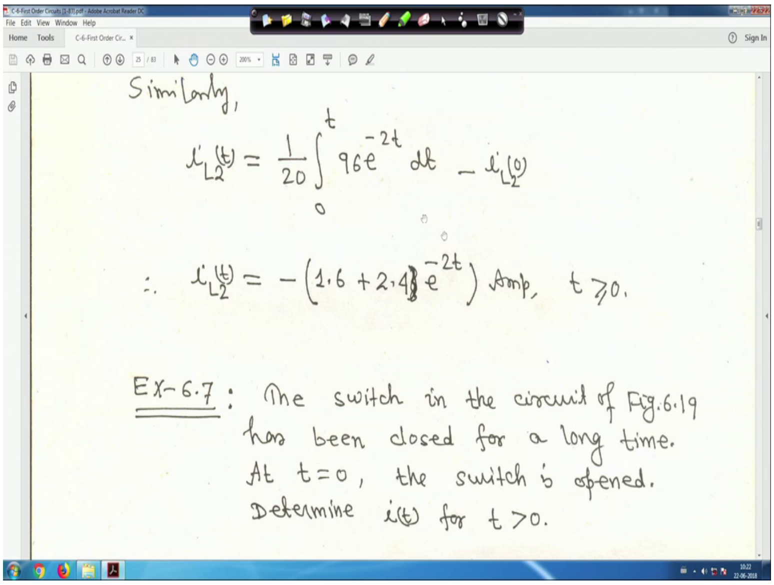

So, this is a question to you that why it is? So if you put all if you do the integration and simplify right and you put i L2 0 initial condition that i L2 0 I think it was 4 ampere, you put it here 4 ampere and you will get i L2 t is equal to this simplification minus in bracket 1.6 plus 2.4 e to the power minus 2 t bracket close ampere, this is for iL2.

Problem is very simple, but only thing that i L1 and i L2 why minus sign, right? This is a question to you. So, after this is a typical problem everything is and this voltage vt means this whenever we are taking that your what you call at t is equal to 0. So, this voltage vt; that means, this is the voltage we have taken, when this switch is opened right. So, this is my v t and this same voltage is impressed across this one and across this one. That is why that i L12 and i L22 we have obtained and initial current is given right.

So, only thing is that minus i L, why minus i L1 0 and why minus i L2 0 in this 2 expression have been taken? This is a question for you right. So, next one is that another example in this case, the switch in the circuit. Example 7 the switch in the circuit I will show you has been closed for a long time right and at t is equal to 0. The switch is opened determine I t for t greater than 0. You have to find out t the switch was closed and has been closed for a long time.

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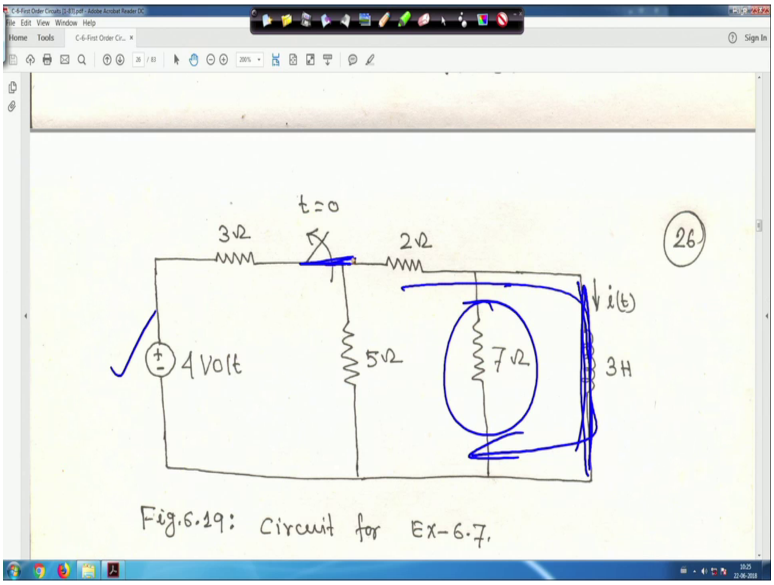

If this switch is closed for a long time; that means, this switch was closed right the switch was closed and in that case what will happen? If the switch is closed for a long time then this inductor will behave as to DC because it is a DC source it will be as short circuit.

In that case, what will happen? This resistance as though current will flow through this resistance it will be completely isolated because, there just I am telling the current flow will take like this current flow will take like this. Because, this is the switch was closed for a long time. So, for DC when switch is closed for long time inductor will act a short circuit whereas capacitor act as open circuit this things you have to keep it in your mind.

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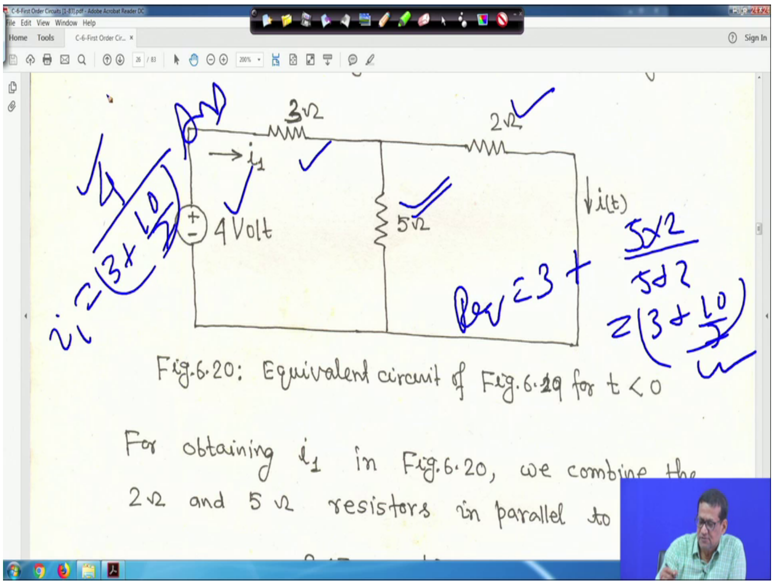

So, if it is so just looks just see the how is the circuit. I think here I might have made it for you. So, this if it is so this is the equivalent circuit I told you this thing will not be there. This 7 ohm will not be there because this inductor is short circuited. So, that no current will flow; so circuit will be like this. So, this 7 ohm should not be there. So, that is why it is 4 volt and some current i 1 is flowing here right, i 1 is flowing and this 5 ohm and 2 ohm are in parallel in this current; it is i t right. Now if you just say if you look into this then your that for obtaining the current i1, it is simple DC circuit, it is simple.

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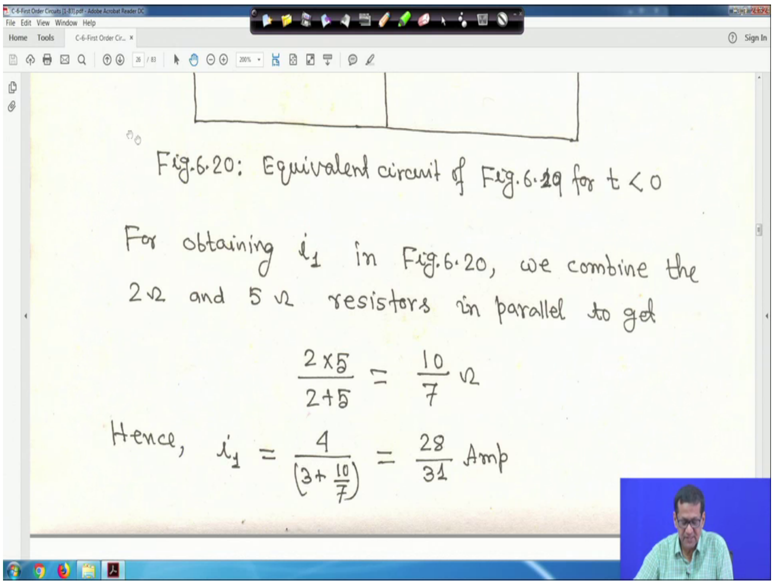

For obtaining the current i1 this 5 ohm and 2 ohm, they are in parallel right with that this 3 ohm in series.

So, R equivalent will be 3 plus your 5 into 2 by 5 plus 2 that is your 3 plus 10 by 7 ohm right. This is R equivalent and therefore, therefore, i 1 therefore, this i 1 will be your, I mean if you take this equivalent one then I am not drawing the second circuit is understandable to you; therefore, it will be 4 divided by 3 plus 10 by 7 ampere because this source is 4 volt this source is 4 volt right. So, let me clear it so.

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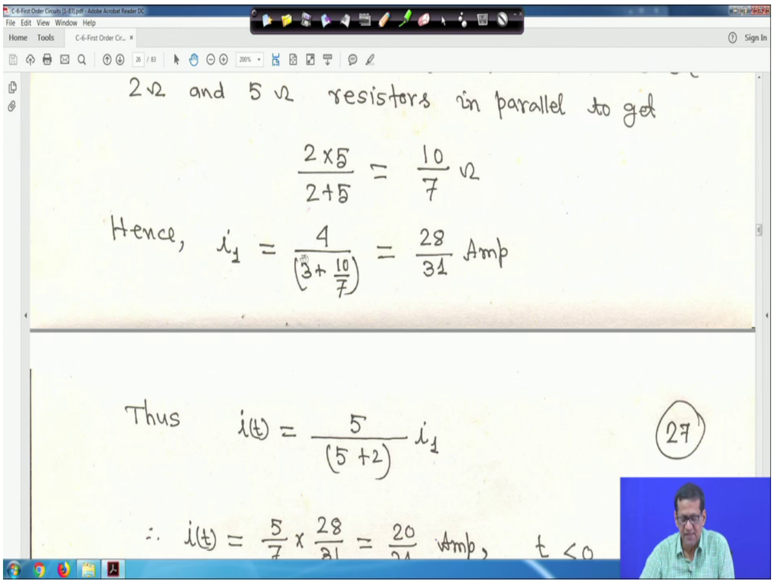

So, if this is your what you call that i 1 is equal to 4 by 3 plus 10 by 7 28 upon 31 ampere. Now, this current division i t will be 5 by 5 plus 2 into i 1 right now, this i 1 you know this i 1 you know.

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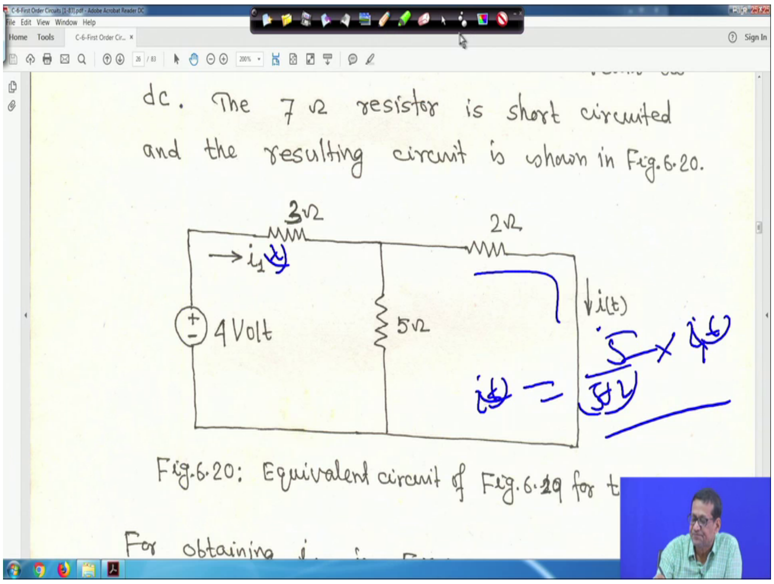

So, your i t will be this i t will be in terms of t say here also if you want it is a function of t say. So, it will it will be the current division what is the current flowing through this 2-ohm resistance that is your i t is equal to 5 by current division 5 by 5 plus 2 into your i 1t right.

Is a current division so 5 by 7 into i 1t? So, let me clear it sorry right.

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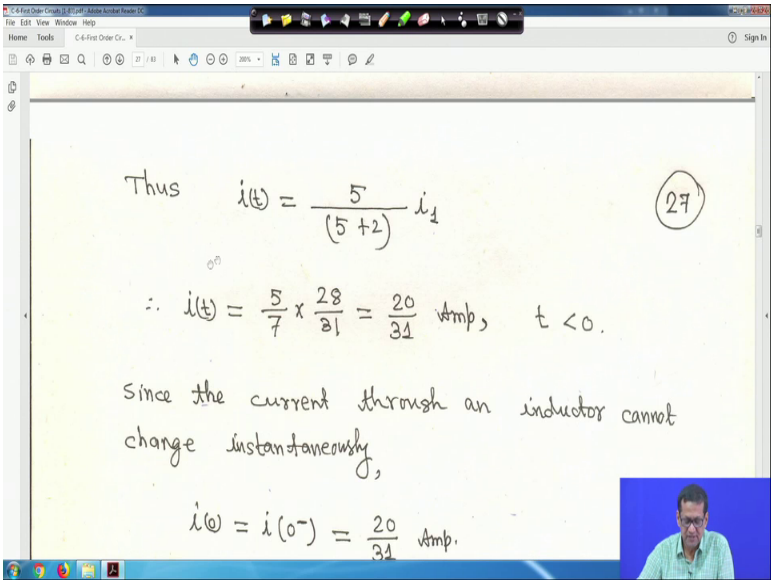

So, in this case this is 5 by 5 plus 2 into i1. So, that is your i t your what you call i t will be your this is actually just 1 minute one correction I will make it. So, better you do not put it I simply write your I simply write it i right. So, 20 upon 3 ampere for t less than 0 right it is initial condition. So, by mistake I have made it i t. So, t better not right simply you put I right.

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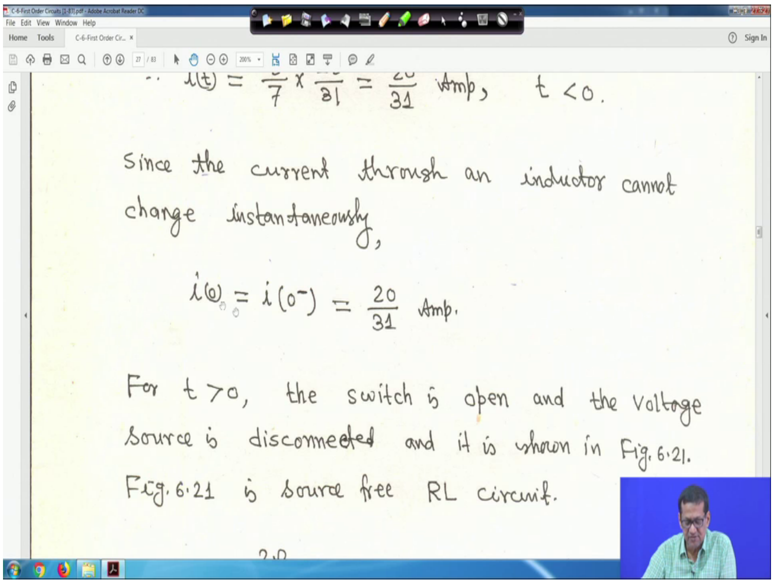

So, let me clear it so since the current through an inductor cannot change instantaneously; that means, i 0 is equal to i 0 minus is equal to 20 upon 31 ampere. This is the initial thing right for t greater than 0 the switch is open right.

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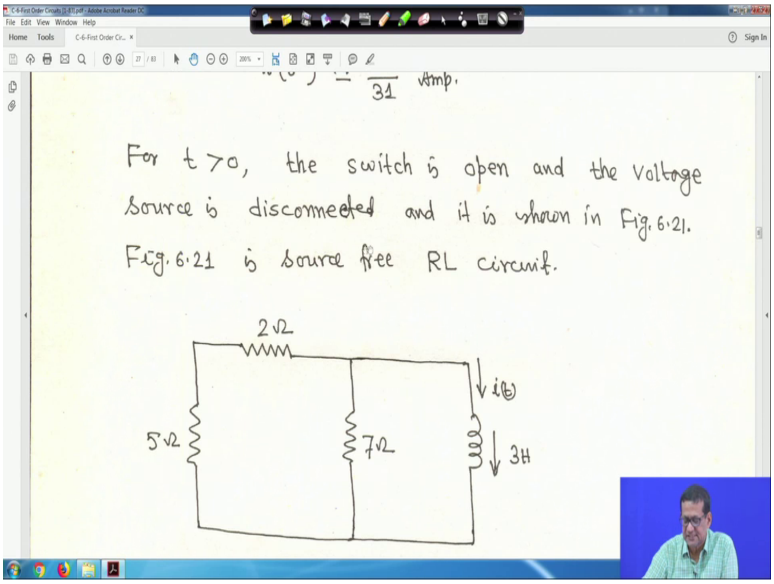

And the voltage source is disconnected and it is shown in figure this thing at t greater than 0 the switch is open. So, come to the circuit first right the circuit first at t greater than 0 the switch is open the switch is open means this part is not there this is part is not there right. So, if this part is not there let us see the how the circuit is right.

So, in this case in this case, that your this i t is there 3 Henry 3 Henry inductor is there and this 2 ohm and 5 ohm are will be will be in series right so; that means, that means this 2 plus 5.

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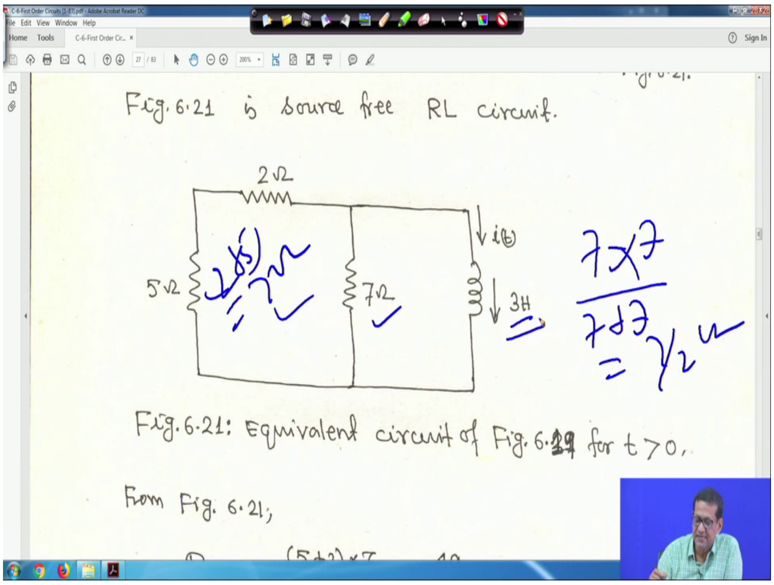

This is your 7 ohm and this 7 ohm 7 ohm are in parallel. So, equivalent will be 7 into 7, right by your 7 plus 7. That is actually the 7 by 2 ohm right actually 7 by 2 ohm. So, this equivalent is 7 by 2 ohm then your tau will be l upon R whatever time constant will come your L is 3 Henry.

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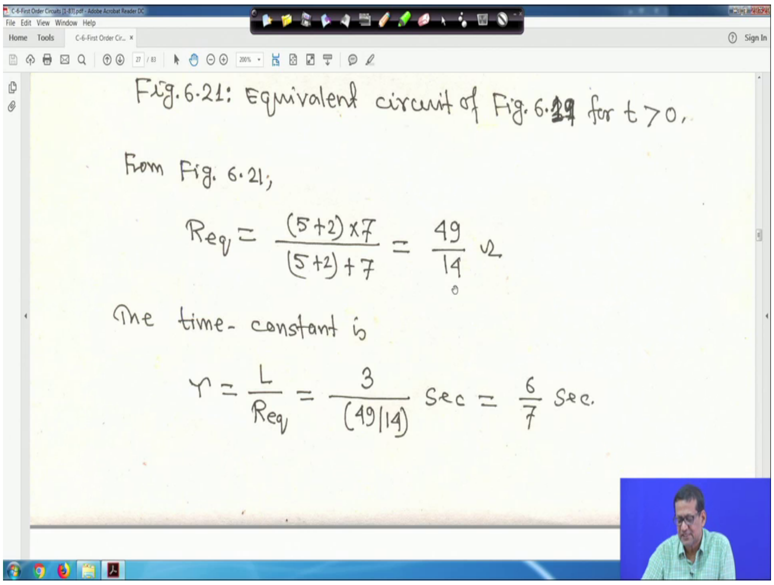

So, in this case, your R eq is equal to 49 by 4 that is 7 by 2 ohm right I didn't written for that, but it is 7 by 2 ohm so time constant is l upon Req.

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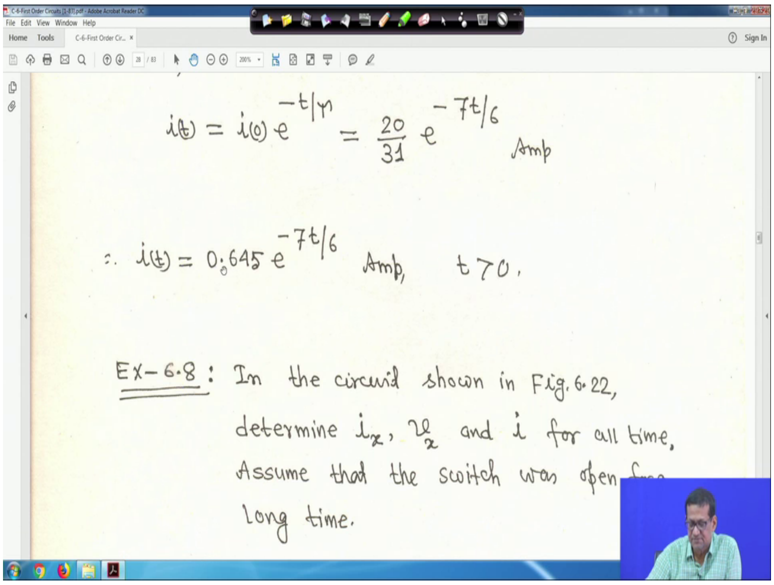

So, 3 upon 49 by 14; so 6 by 7 second so thus i t is equal to i 0 e to the power minus t by tau this we know. So, that is 20 upon 31 and tau you got 6 by 7 second you substitute you will get 20 upon 31 e to the power minus 7 t upon 6 ampere.

So, i t is equal to; that means, i t is equal to 0.645 e to the power minus 7 t by 6 ampere that is for t greater than 0. So, this is a simple problem only you have to little bit your what you call some basic to that dc. If the switch is closed for long time, that inductor will behave as a short circuit and for the capacitor it will behave as a for DC that open circuit. This thing you have to keep it in your mind right. So, this is I hope I hope you have understood this simple problem.

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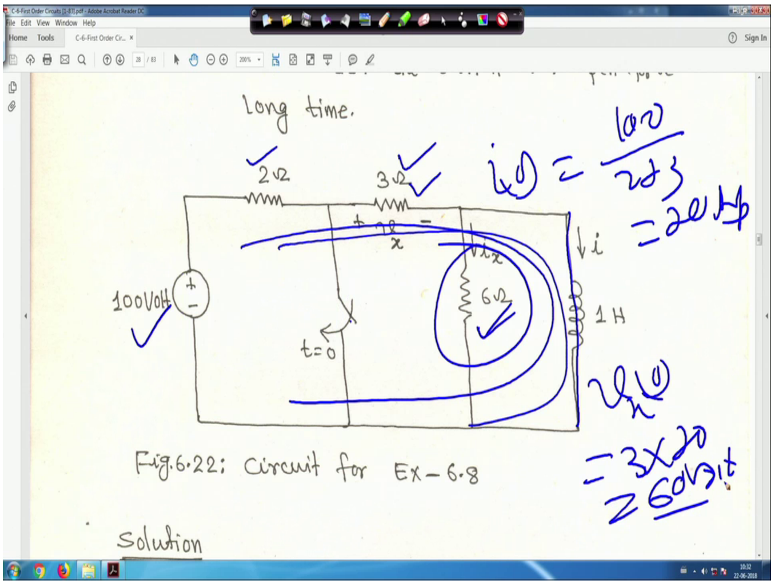

So, next one is in the circuit shown in figure 22, you have to determine I x v x and I that is your you have to determine your i x this is your i x then your v x that is the voltage across this 3-ohm resistance and i. Can you this is the i for all time right that is i which current flowing to one in the inductor assume that the switch was open for a long time here in this case it is given opposite that switch was opened for a long time right. So, if switch was opened for a long time, first you have to see that initial condition right so let me clear it.

So, when the switch was open for a long time. So, this will be the circuit because if switch is open for a long time if the switch is open for a long time; that means, that it is a DC volt 100 10 volt right and inductor behaves as a short circuit inductor behaves as a short circuit so, it is short. So, in that case what will happen that if it is open for a long time, the current will flow like this and there will be no current in the 6-ohm resistance because it because it behaves like a short circuit. So, there will be no current here. So, it will take this path it will go like this. So, no current will flowing so initial current to i x 0 is 0 right and initial through the inductor initial current is it is 2 ohm and 3 ohm will be this is open right.

It has open for a long time and only at t greater than 0 it was closed. So, it was open for a long time so initial current that i 0 will be 100 divided by 2 plus 3 that is 20 ampere that is the initial current that is flowing to the inductor right and that i x 0 at it will be 0. So, so let me clear it and if you try to find out the initial voltage v x 0 that will be your 3 into 20. So, it will be 60 volt right, that mean if you want to find out what is the initial voltage v x 0 it will be 3 into 20 that is your 60 volt right.

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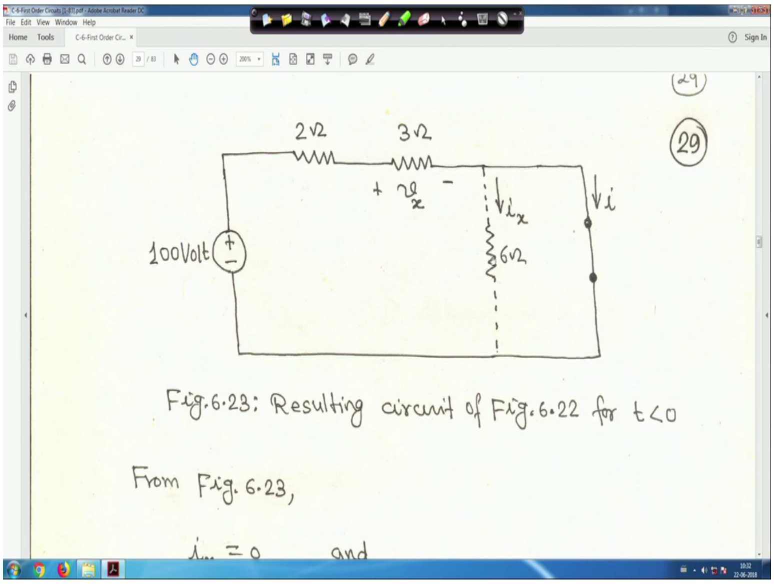

So this is the circuit I have drawn. So, 6 ohm is totally isolated right it is it is no current is flowing here while switch was open for long time and this is 2 ohm 3 ohm are in series I made it for you.

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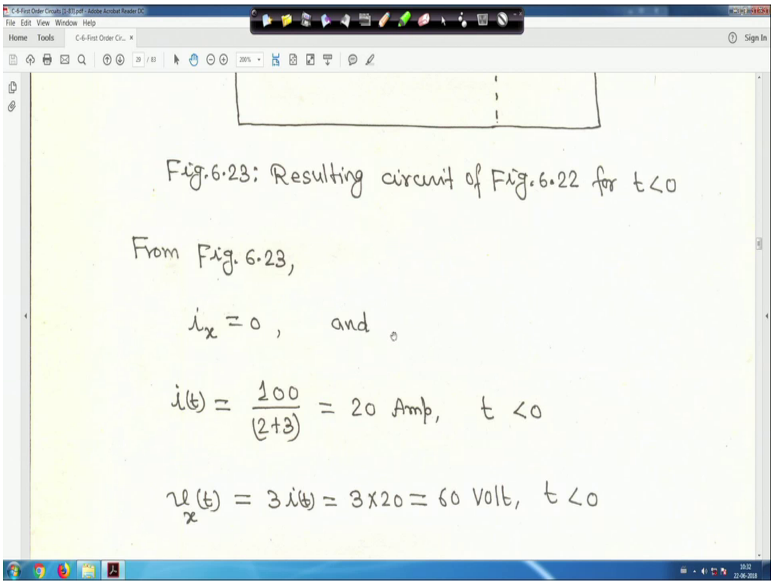

So, i x 0 is equal to 0 I told you as i x is equal to 0 initial and i t it is.

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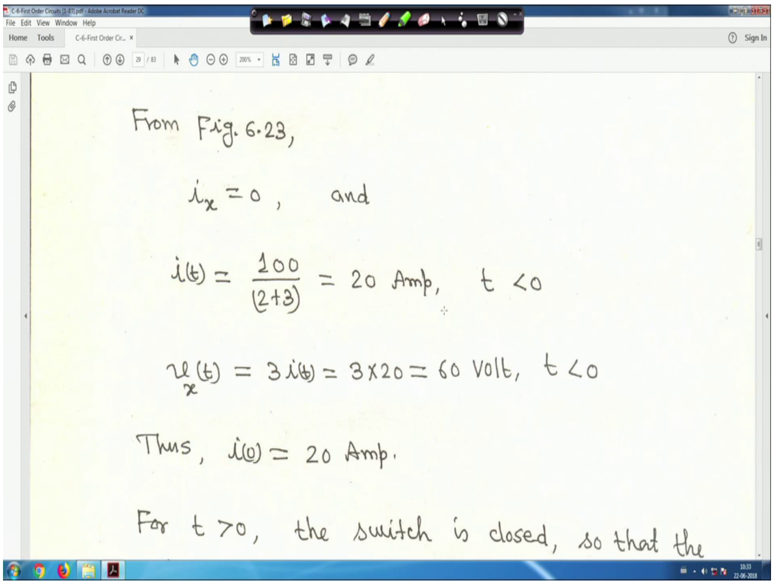

Actually your, what you call this is actually a switch was a closed for this thing. So, I suggest a better instead of writing t you just write I initial condition the way I wrote i t 0 with do not write t, this is while making it I made some your what you call the writing error. So, it just make i 0 is equal to 20 ampere and I made this one v 0 right that is your 60 volt.

This is because this is for t less than 0 of course, one thing is there as I have mentioned t less than 0 or t less than 0. So, i t here also you can make it for to all t less than 0 it is also i t also is valid, but you just make it for i 0 and v x 0 both are valid, but still I have made it, because as we have as we have mention it here if you have mention I overlook this one if you have mention in this one then I t and v x t is if it is not mentioned then you put initial value that i 0 and v 0 right. So, and that is why i 0 is equal to I write it 20 ampere that is the initial current right. So, let me clear it.

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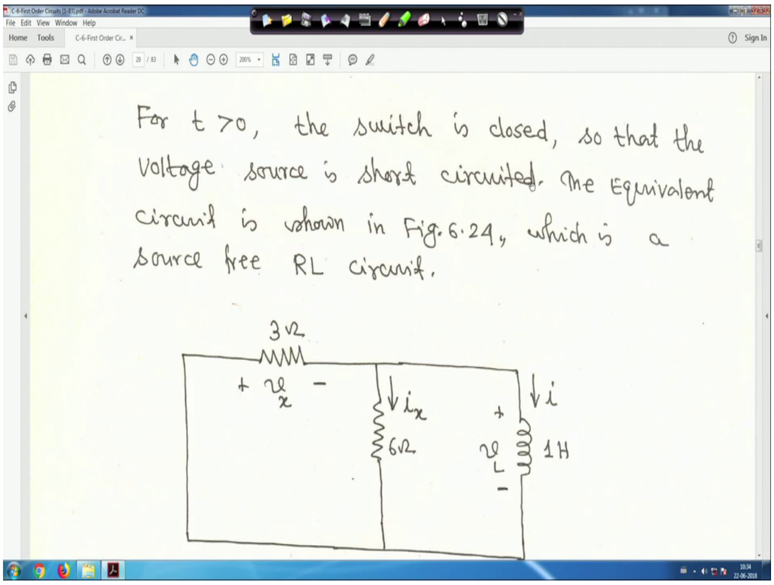

So now, for t greater than 0 the switch is closed right switch is closed. So, that the voltage source is short circuited; that means, as soon as your if you look into the circuit when if you look into the circuit at t is equal to 0 this switch is closed; that means, this voltage is this voltage source is short circuited because this is short right. So, what will be the equivalent your what you call equivalent circuit in that case. So, in that case what will happen? That this is your equivalent circuit voltage source is short circuited. So, this 3 ohm and 6-ohm resistor are in parallel right and there equivalent will be 6 into 3 by 6 plus 3. So, 2 ohm right so and this is one Henry inductor.

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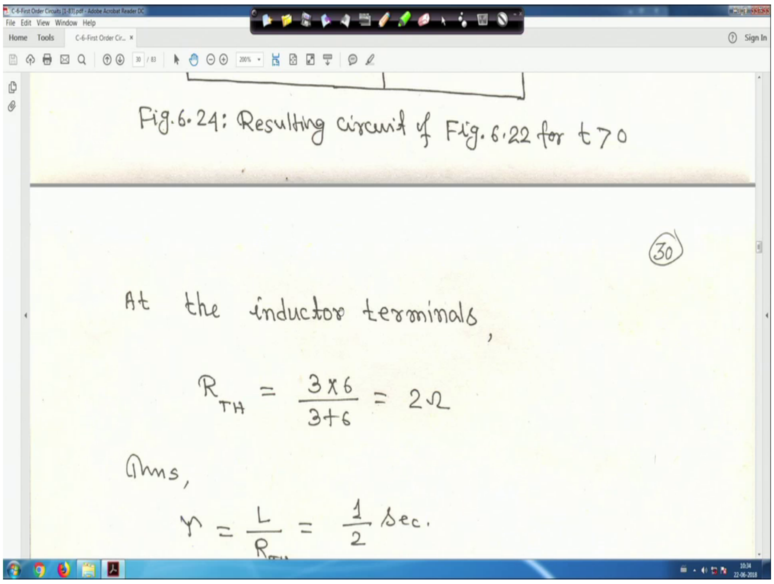

So, that means if you are writing parallel resistance, but the same time at the inductor terminal if you make it like this R the venin that is nothing but the 2 resistors are in parallel 3 into 6 by 3 plus 6 is equal to 2 ohm right. And tau is equal to we are writing L upon R the venin that is L is 1 Henry.

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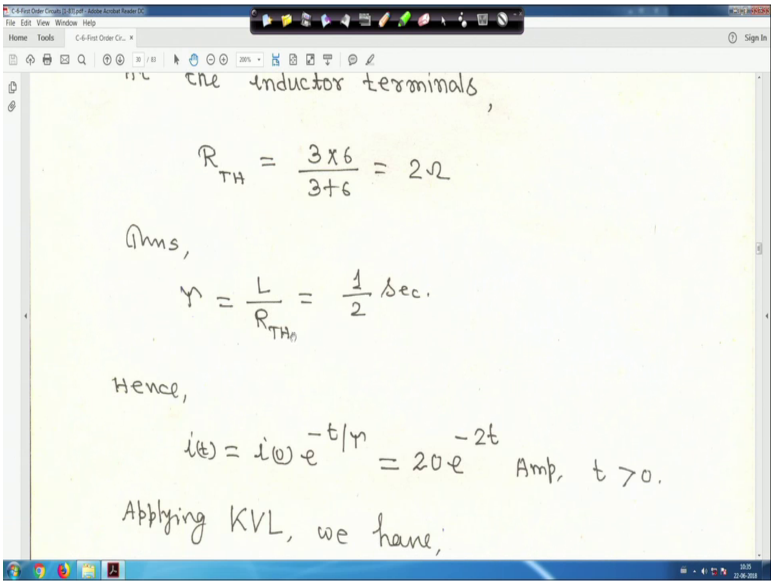

Here L is given 1 Henry and your this one given that 2 your R the venin is 2. So, half second tau is equal to half second.

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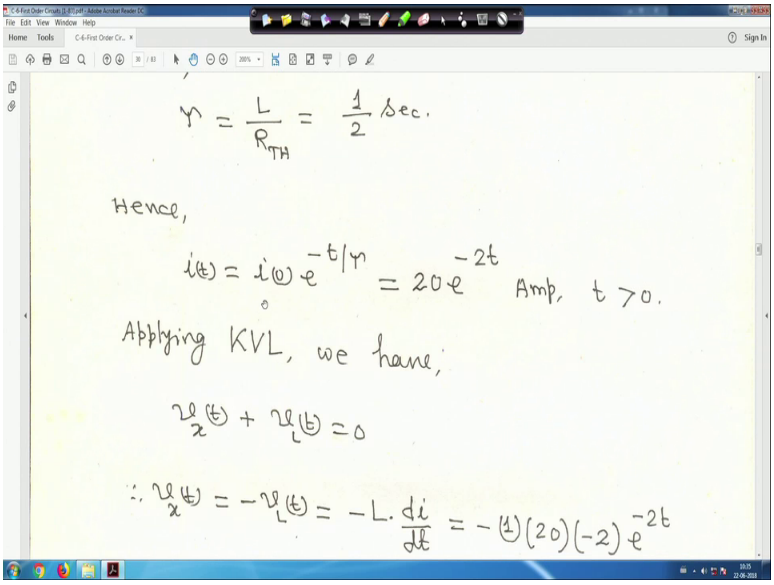

Now, we know that i t is equal to i 0 the source p circuit we know I 2 is equal to i 0 e to the power minus t upon tau. So, i 0 is equal to 20 and tau your tau is equal to half so e to the power minus 2 t ampere for t greater than 0 right.

Applying KVL we have v x t plus v Lt is equal to 0 right now if you apply KVL in the circuit if you apply KVL here if you apply KVL here.

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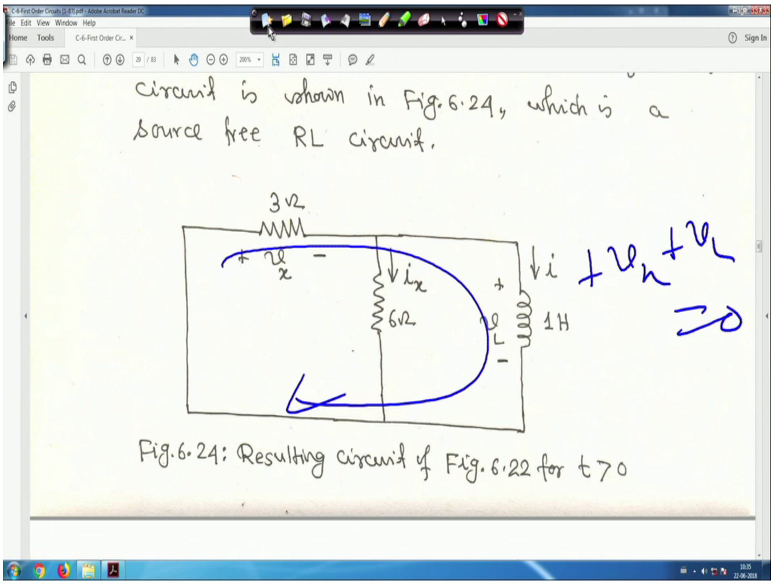

So, if you look this that this is v plus v x plus v l is equal to 0 right. So, apply KVL in the circuit. Let me clear it right.

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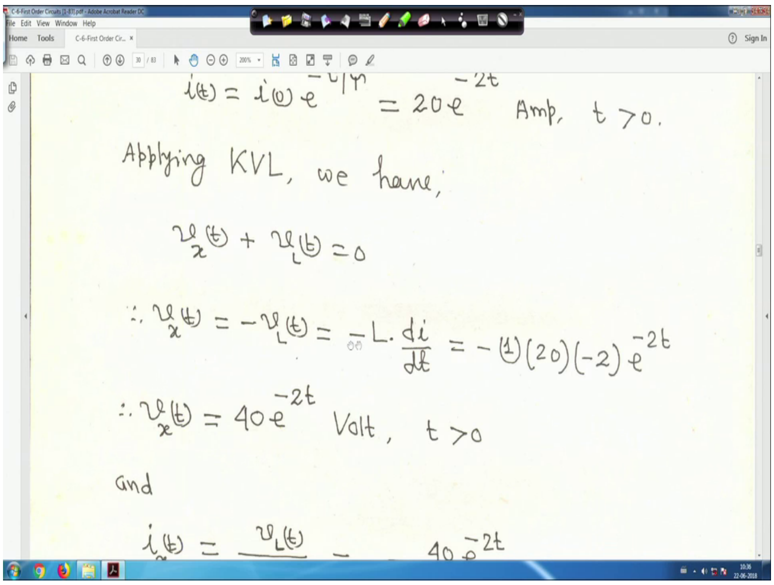

So, v x t is equal to minus v Lt is equal to minus L di upon d t. So, it is L is 1 Henry minus 1 and di upon dt is you take the derivative of this 1; so, 20 into minus 2 into e to the power minus 2t. So, v x t will be 40 e to the power minus 2 t volt that is for t greater than 0 right.

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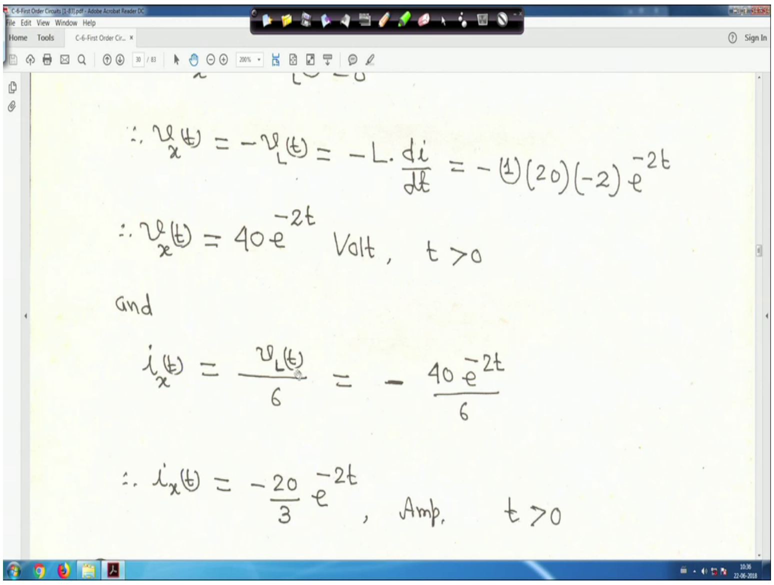

So, and I x t is equal to v Lt upon 6 because this whatever voltage you got v Lt right this 6 ohm and this 6 ohm and 1 Henry are in parallel.

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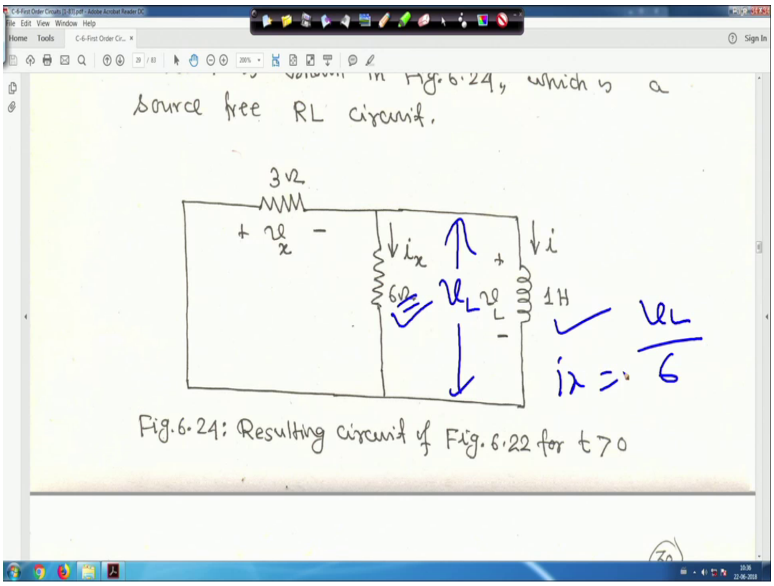

So, whatever you get across this is v L right then i x will be your in general v L not writing t. Later, we will see that understand this divided by 6-ohm resistance is the current right.

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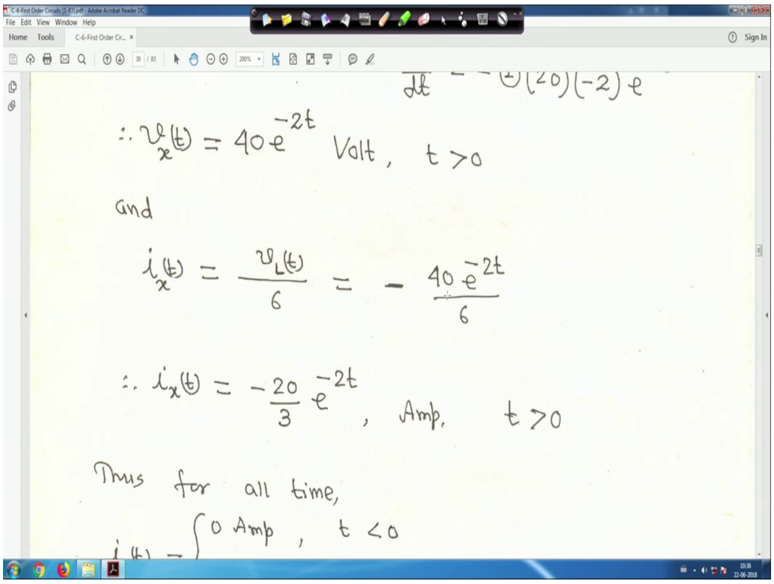

So in this case, we are writing i x t is equal to v Lt upon 6. So, v your what you call v Lt is given that you are we have got v Lt is equal to your minus v Lt is equal to minus L di this much right.

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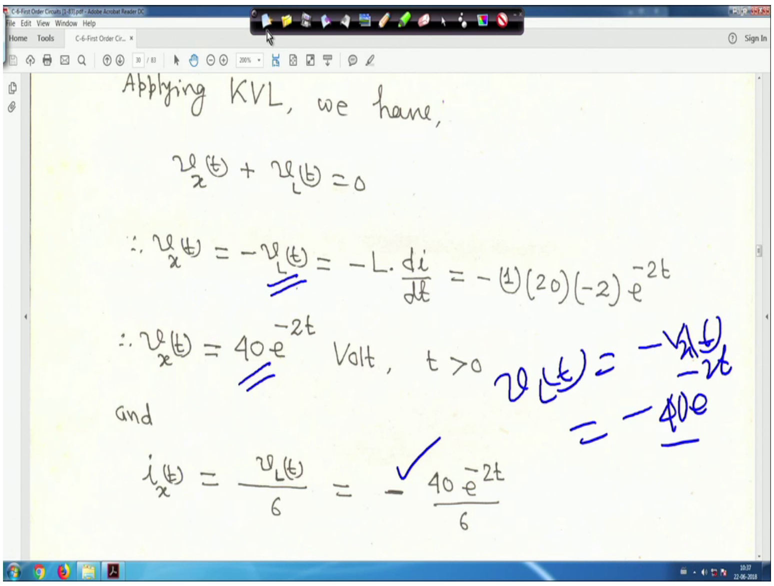

So, v x t is equal to this much and v Lt we are writing minus why because here this v x t is equal to minus v Lt and v x t will got this much; that means, our v Lt is equal to your minus v x t. So, that is actually minus 40 e to the power minus 2 t that is why this minus sign is here.

Right so, minus 40 e to the power minus 2 t upon 6 so i x t is equal to then minus 20 upon 3 e to the power minus 2 t ampere this is it is set for all time.

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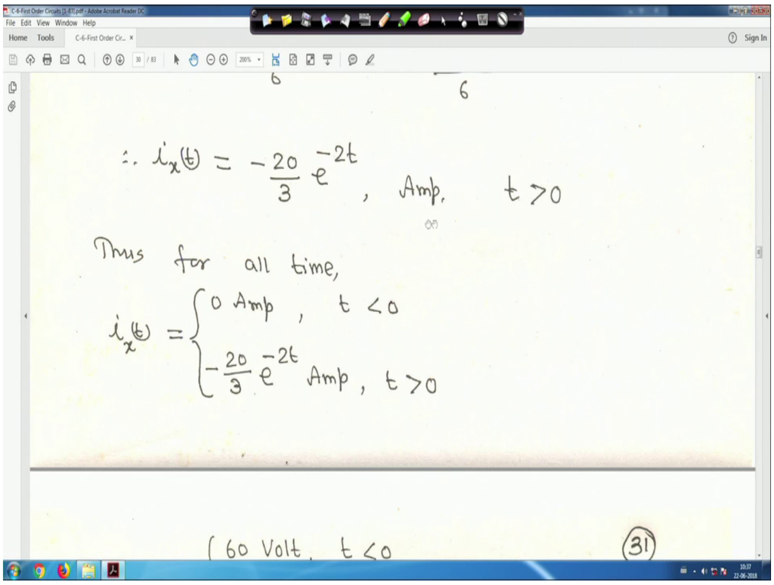

That means, if you mention this, i x t is equal to 0 ampere for all t less than 0 and i x t is equal to minus 20 upon 3 e to the power minus 2 t ampere for t greater than 0. This way you should write when you say all t means it is actually in general it is actually minus infinity to plus infinity right. So, that is why for 0 ampere it is like this t less than 0 and it is i x t minus 20 upon 3 this we got.

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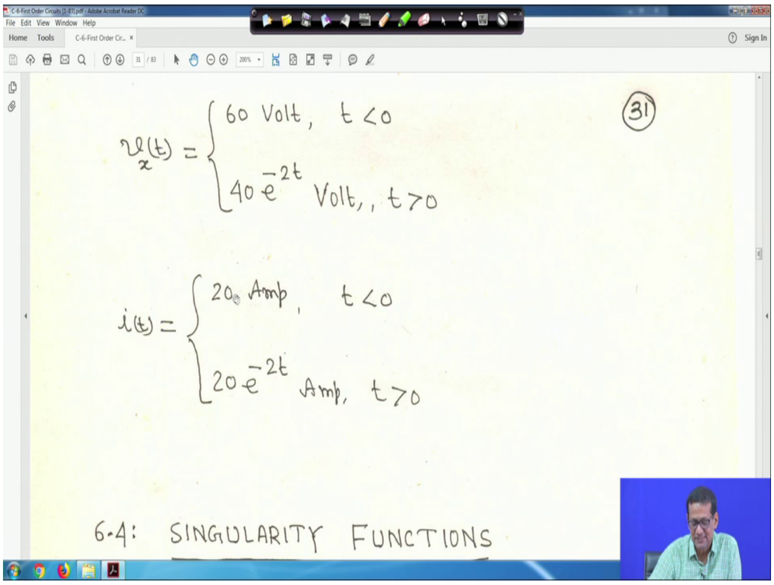

Similarly, for voltage we got that 60 volt that t less than equal to 0 right that is and 40 e to the power minus 2 t while you mention this one at that time v x t is equal to 60 volt. Right, if you do not if you do not try to mention then we will assume that it is initial value 0, but for anything less than t less than 0 it is 60 volt right. Similarly, it is also initially 20 ampere you got that is for all t less than 0 and because switch was closed for I think in this case it was open for a long time and 20 e to the power minus 2 t ampere 40 greater than 0.

If says all time then in this way you will write the answer right this way you write the answer in general, it is minus infinity to plus infinity whatever break up is there for time you write right.

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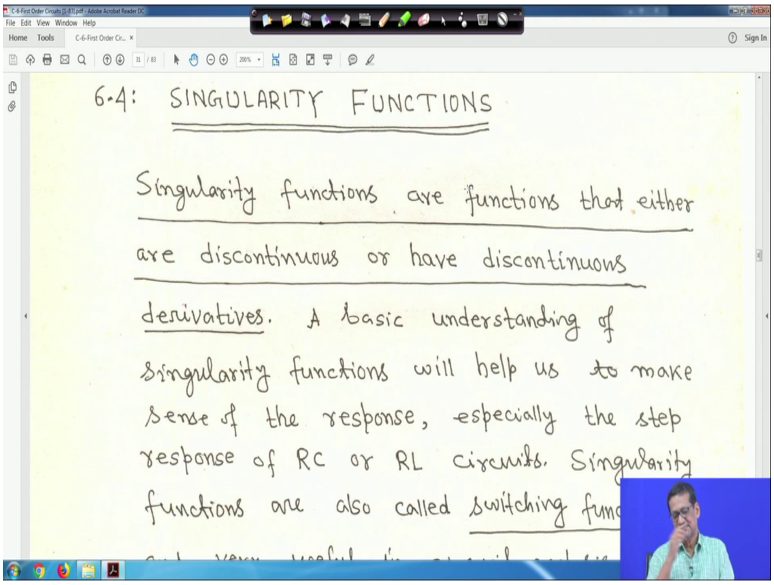

So, next is I hope up to source I know this is up to this is source free circuit whatever we have studied. So, for right so next is that a singularity functions because, we have to take a now you are your what you call that where source is there in the circuit. So, before that little bit we were learn about we will learn about singularity function.

So, singularity function are function that either are discontinuous or have discontinuous derivatives right. So, a basic understanding of the singularity function will help us to make sense of the response specially the step response of RC or RL circuit right. So, singularity function are also called the switching function right.

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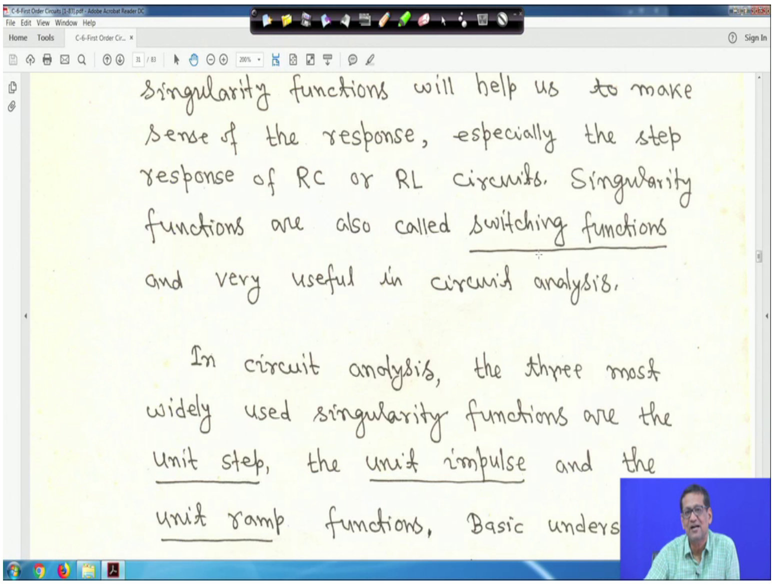

So, sometimes it is called all I have underlined the switching function and very useful for circuit analysis right.

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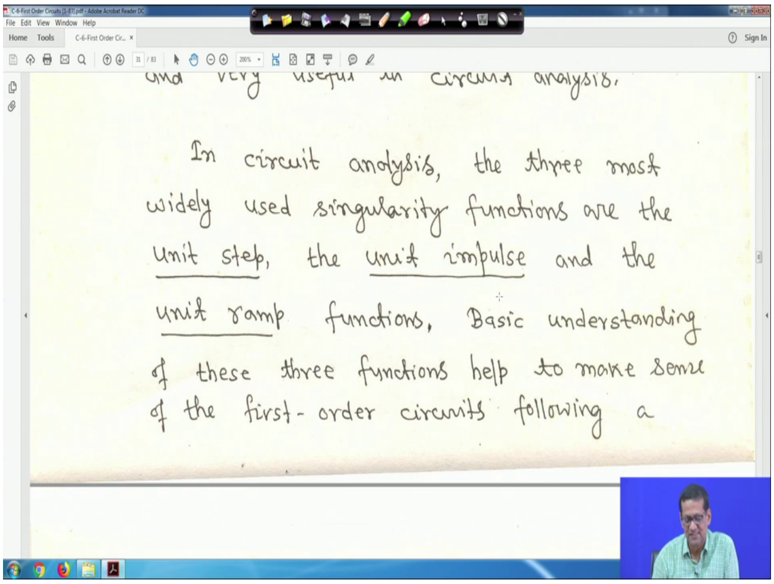

So, in circuit analysis the 3 most widely used singularity function are the unit step function the units impulse and the unit ramp. These 3 functions one is unit step the unit impulse and the unit ramp all are underlined right. So, basic understanding of these 3 functions helps to make sense of the first order circuit right.

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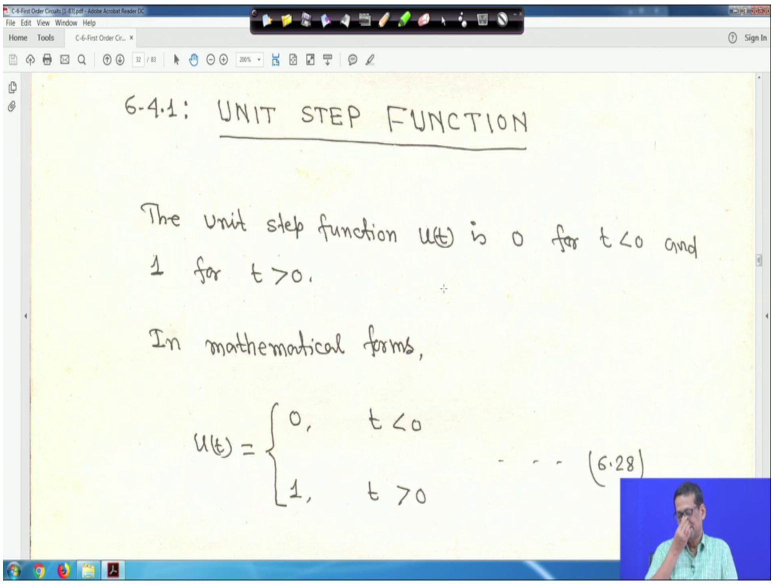

So, following a your what you call sudden application of an independent DC voltage or current source first we will understand this one by one. Then we will go to that your what you call that your at that time source will be there in the circuit at that time, you will see the transient response and you will find things are very easy right.

So, unit step function first right basically unit step function this kind of singularity function step function, ramp function all set of things you will find mostly used in the circuit thing as well as in the control system right. So, for unit step function that u t is 0 for t your what you call for t less than 0 right and for and 1 for t greater than 0. So, u t is equal to 0 for t less than 0 and u t is equal to 1 for t greater than 0 right. So, this we will define the unit function your what you call the unit step function.

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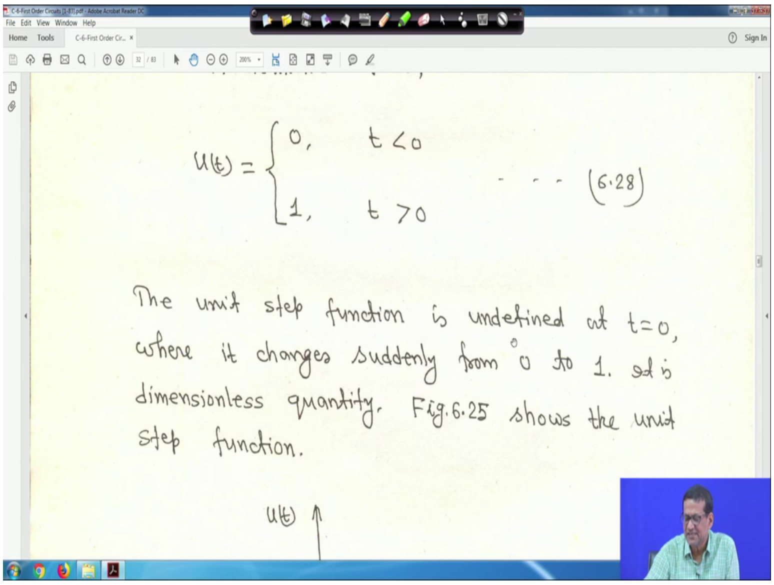

So, so it is, but it one thing is there it is undefined at t is equal to 0, but when it is it is undefined at t is equal to 0 it is less than 0 t less than 0 it is 0 t greater than 0 is 1, but is undefined at t is equal to 0 right where it changes suddenly from 0 to1. And second thing is it is dimensionless quantity this thing we have to keep it in our mind it is dimensionless quantity. So, figure 25 shows the unit step function I will show you the figure. So, this is the unit function def time your def for all time how you define unit time function.

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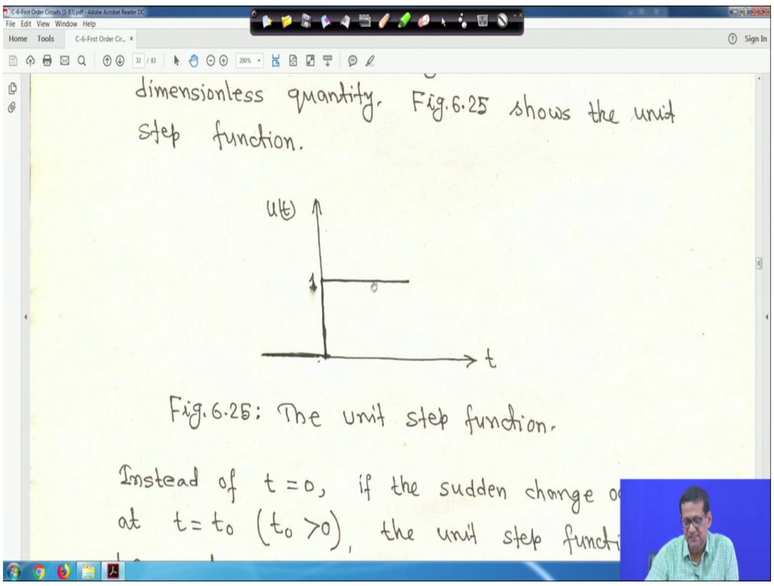

So, this is your unit time function, but remember at t is equal to 0 it is undefined right. So, in for this case u t is defined this is unity and this is like this we have drawn because for t less than 0 it is your 0 so, but at t is equal to 0 your what you call it is undefined. So, instead of t is equal to 0 if the sudden change occurs at t is equal to t 0 that is t 0 greater than 0 right. So, what will happen? Suppose, instead of t is equal to t 0, if the sudden changes occur at t is equal to t 0 where t 0 greater than 0.

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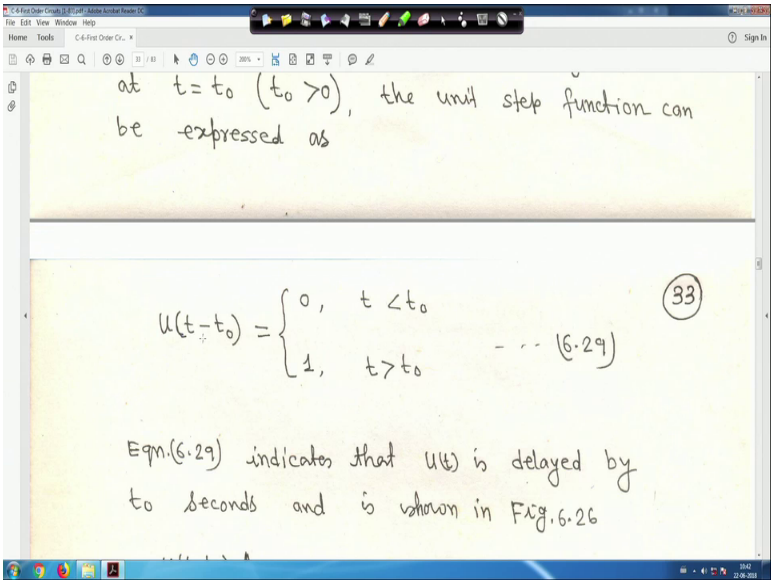

The unit step function can be expressed as that we can write if t 0 greater than 0 at a t is equal to t 0 then u t minus t 0 is equal to 0 for t less than t 0 and it is 1, for t greater than t 0 and at t is equal to t 0 it is undefined right.

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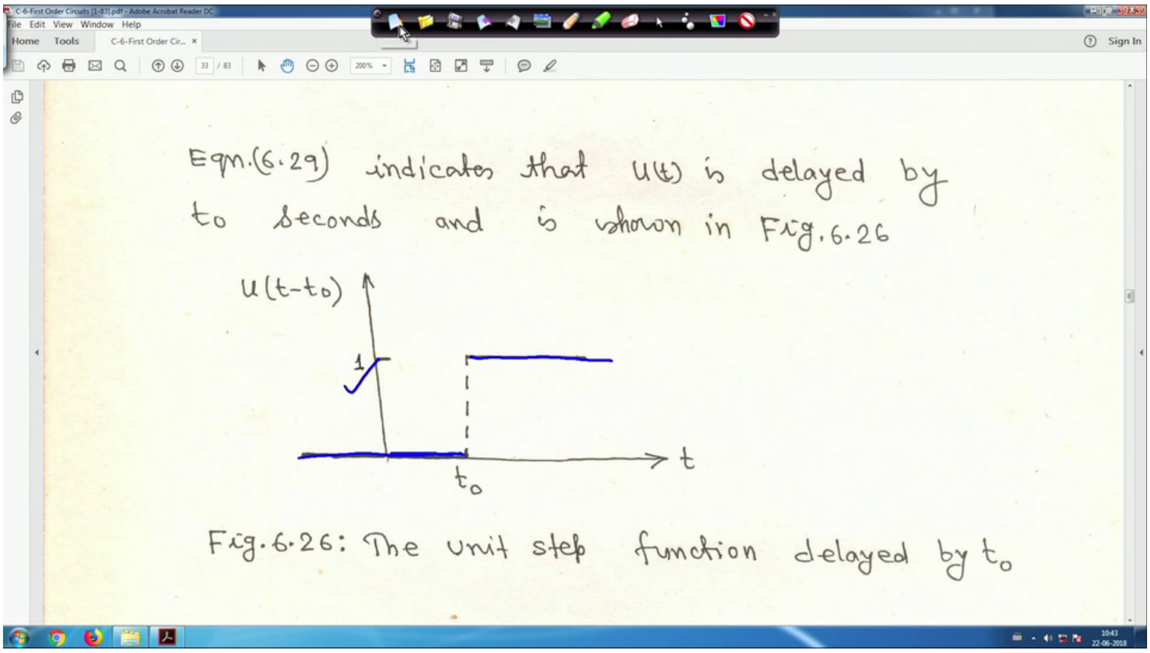

So, 29 indicates that u that your u t is delayed by t 0 second and is shown in figure. So, it is delayed right so, it is delayed it is it is made it has been made like this it this thing is your less than t 0 and this is your greater than t 0 and right and this is your 1. So, this is u t minus t 0 that it delayed by t 0.

Now, if it is advanced by t 0 how it will look like.

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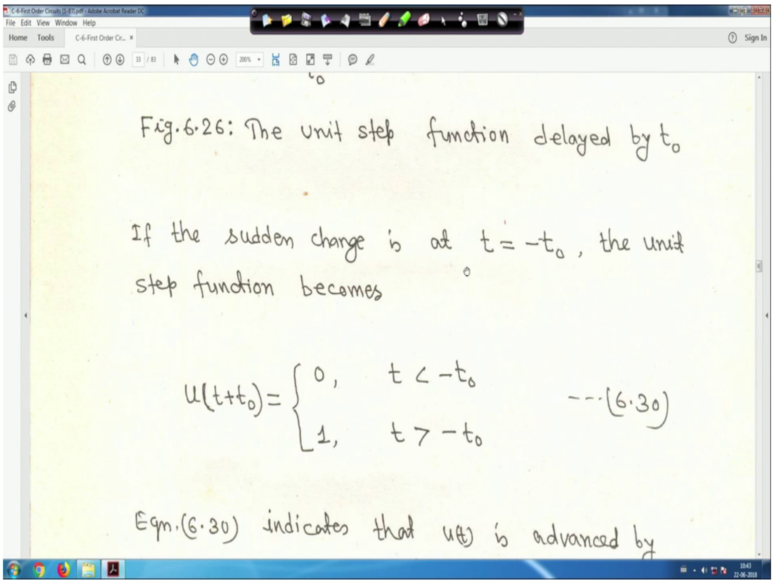

So, next is if the sudden change at t is equal to minus t 0, the unit step function become in that case it is u t plus t 0 is equal to 0 for t less than minus t 0 and is equal to 1 for t greater than minus t 0.

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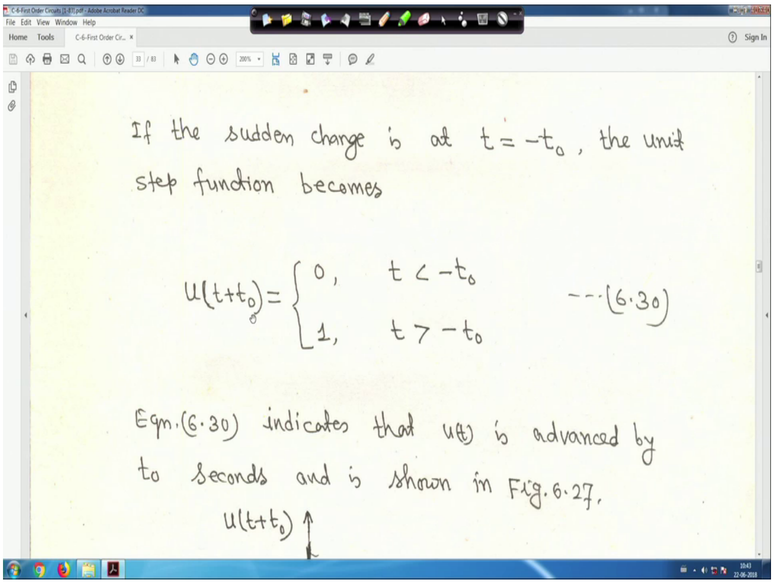

So, this is equation 30 say; so this equation 30, it indicates that u t is advanced by t 0 second and is shown in figure 27.

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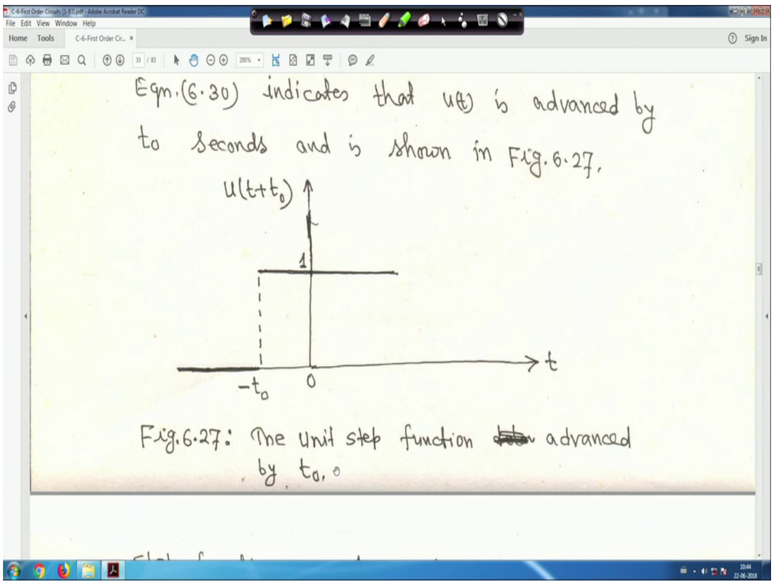

So, it is advance. So, this is minus t 0 right. And this is 1 and this is the thick line again I am not marking by blue color this is a thick line for less than minus t 0 this less than minus t 0 is 0. So, this is thick line and this is your greater than t 0 right and it is it is u t plus t 0 time right. So, unit is your unit step function advanced by t 0. So, this 3 that u t; that means, u t this is u t hope you have understood this u t this is your u t minus t 0 this is the plot and this is your ut plus t 0 right if it is advanced by t 0. So, this is the plot how you will show the unit step function right.

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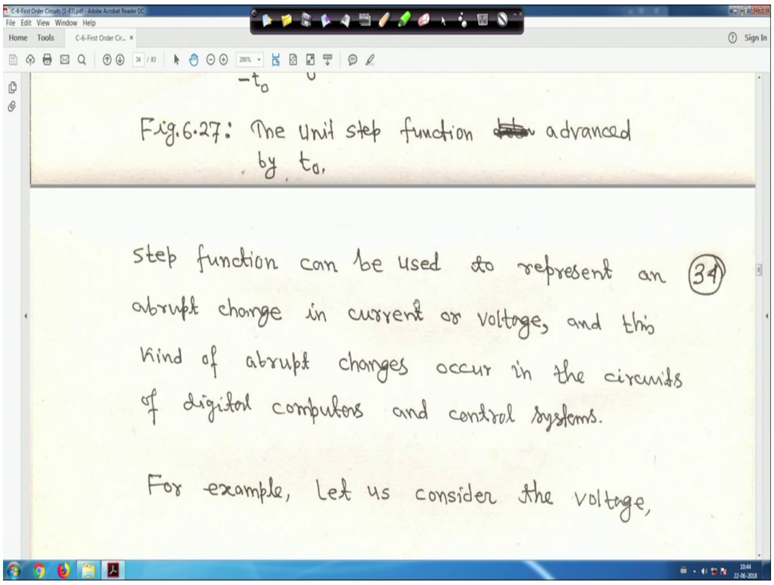

So, step function can be used to represent an output abrupt sorry abrupt change in current or voltage and this kind of abrupt changes occur in the circuit of digital computers and control systems right.

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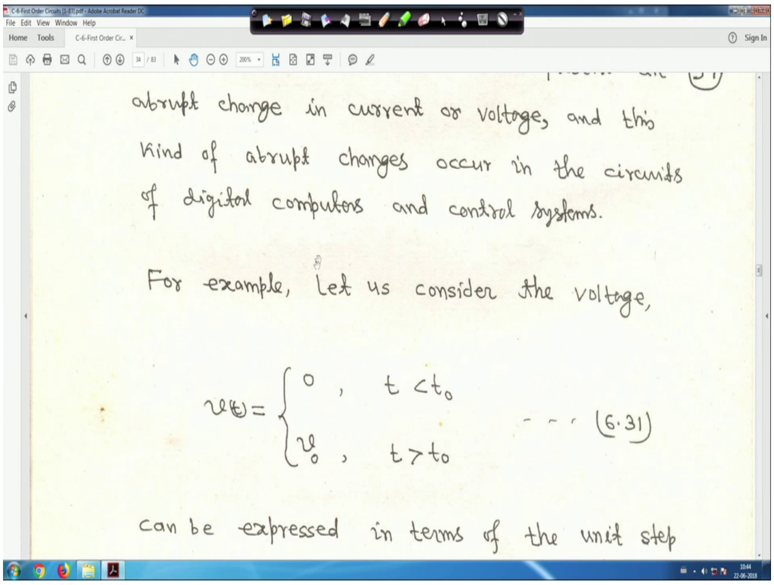

For example, let us consider the voltage let us consider the voltage v t is equal to 0 for t less than t 0 and v t is equal to v 0 for t greater than t 0 this is equation 31. Suppose, this voltage we are writing like this if it is 0 t less than t 0 and v 0 t greater than t 0 you are writing like this.

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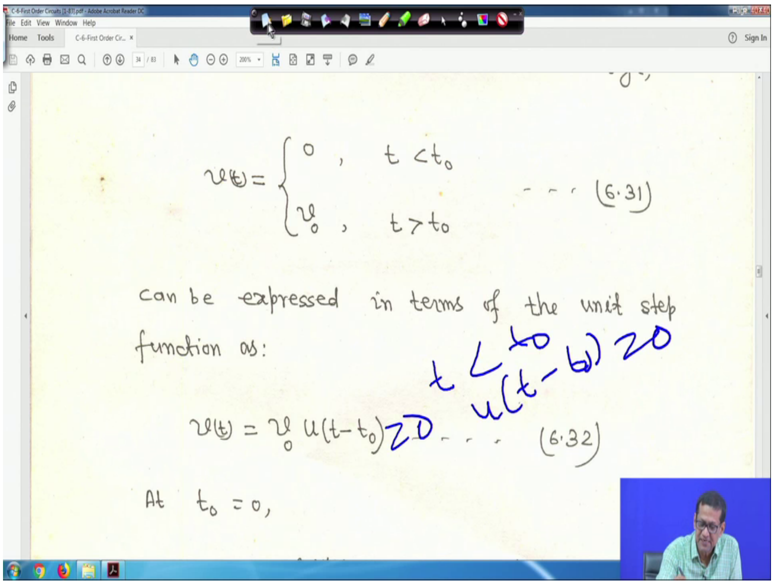

It can be expressed in terms of unit step function as v t is equal to v 0 u t minus t 0. We solve this step function your this thing u t minus t 0 is equal to for t less than t 0 it is 0 and for t greater than t 0 it is 1 and multiplied by u t if this is u t minus t 0. So, this voltage this voltage right if it is given like this we write u t minus t 0 we know for t less than t 0 it will be it will be 0. So, v t will be 0 and for t greater than t 0 you are your u t u t minus t 0 will be 1.

So, in that case v t will be v 0 right this we have seen from that, this we have seen from that right. When t when t less than t 0 your u t minus t 0 is equal to 0. So, in that case v t will be 0, right.

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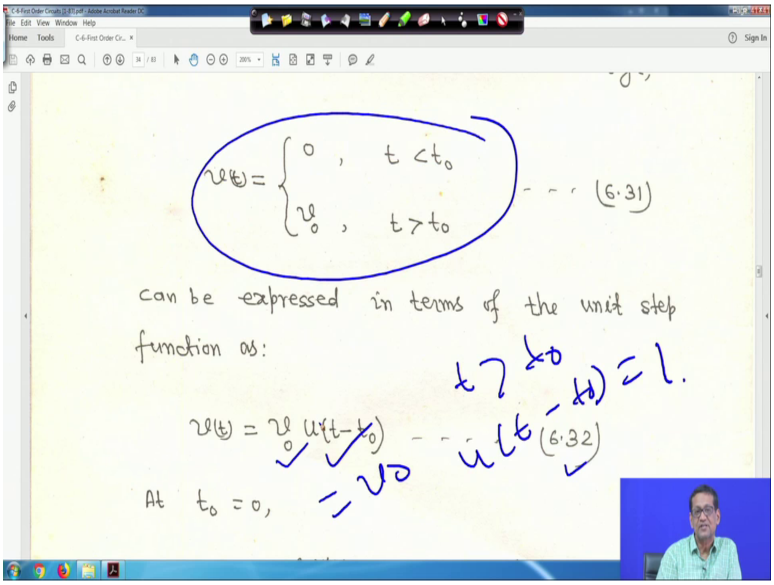

Now, let me clear it so similarly, when your t greater than t 0 u t minus t 0 is equal to 1; that means, this one will be v 0 right. So, this expression this whole thing equation 31 can be written in this form, right. So, it is understandable right this equation can be represented by equation 32 right.

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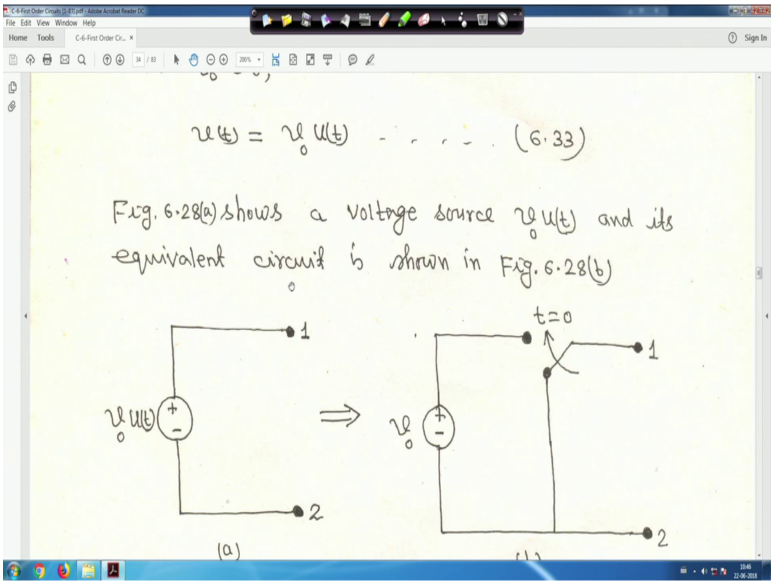

So, let me clear it and at t is if t is equal to 0, if t 0 sorry if t 0 is equal to 0 then this 32 can be written as v t is equal to v 0 into u t right. So, with this just show you the circuit right. So, figure 28 a shows a voltage source v 0 u t and it is equivalent circuit is shown.

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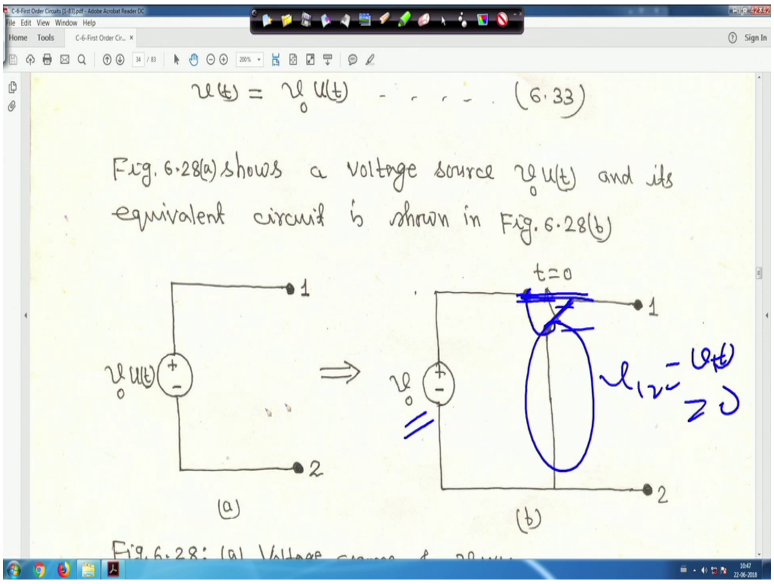

So, this is v 0 ut is of voltage source is given right for t less than 0 it is your what you call u t 0 and for t greater than 0 it will be v 0. So, this when the switch position is like this so1 and 2 this is actually your what you call that it is 0 right because 1 and 2 is short circuit if 1 if it is if it is 1 and 2 make like this.

So, if the switch position sorry if the switch position is like this then it is short circuit right. So, in that case your I can say that t less than 0 for example, right. So, in that case this your what you call there will be no output voltage that v12 is 0 that v12 is equal to v12 is equal to v t is equal to 0 right, but when switch position had gone from this to this I mean when it is there when it is connected forget about this, when it is connected at that time your v one 2 is equal to v t is equal to v 0 right.

So, this if you draw v 0 ut this circuit then your what you call let me clear it this is the equivalent circuit from here. If you pick v 0 and this is your how you will make in a switching logic right how you will make it as switching logic; so, just one just one second right. So, this way you can make it, so voltage source v 0 u t and it is equivalent circuit.

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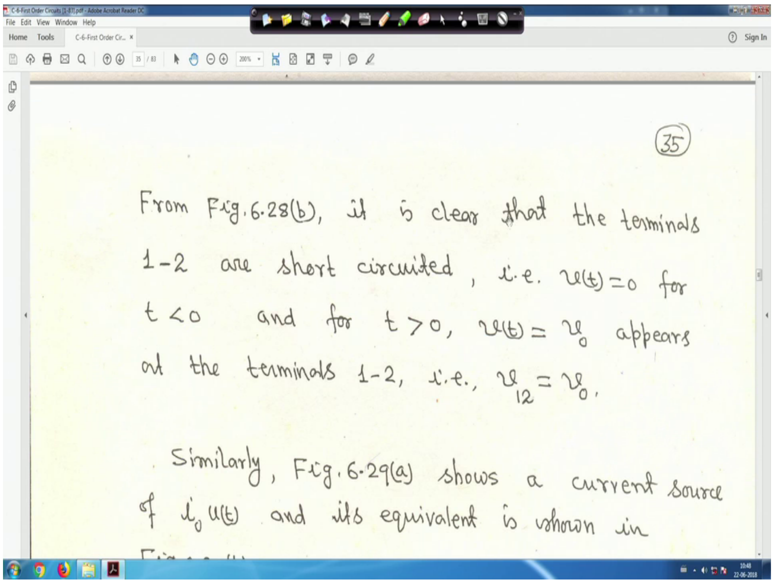

And whatever I said it is explanation given explanation is given when the your what you call it is clear that terminal 1 and 2 are short circuited that is v t is equal to 0, for t less than 0 and for t greater than 0, I told you v t is equal to v 0 appears at the terminal one and 2 that is v 12 is equal to v 0 right. So, today sorry today I have to this I will for this up to this.

Thank you very much we will be back again.