Fundamentals of Electrical Engineering
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Lecture - 34
First order circuits (Contd.)

So, next we will take another problem. So, so many you know, in this case, now we are seeing that your RC circuit. Next we have to see the RL circuit, right. And once DC part will be over, we will go for your what you call single phase AC circuit. And what you call that your resonance then, your maximum power transfer in AC circuit; those things. Then your 3 phase circuit, then magnetic circuit, then 3 things are there, the long way to go. So, DC is for transient and other part, I have solved a lot of problems for you. But, for AC circuit, we will solve very little because, complex number will be involved, right.

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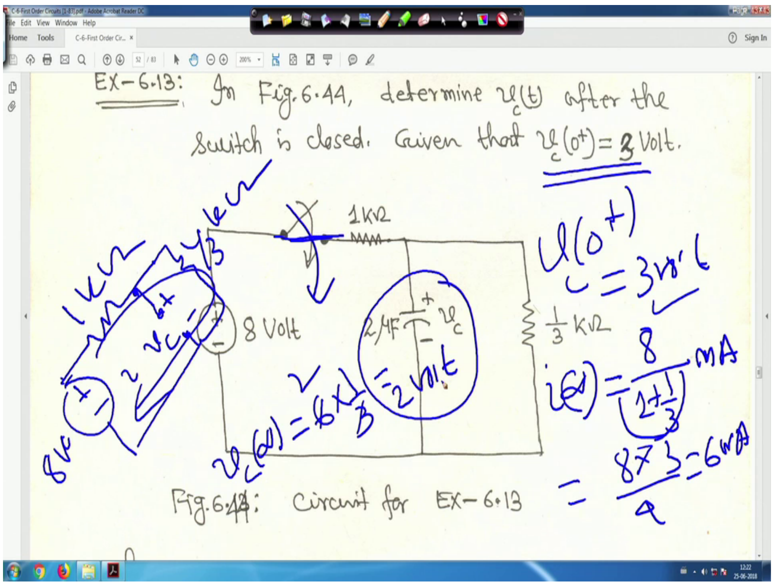

So, anyway come to the next problem. So, hope you are understanding this. So, this is actually you have to find out for this circuit, you have to find out that you are in your in this figure, you have to find out that your V C t. Determine V C t after the switch is closed right. So, switch is closed and initial value of V C 0 plus is given 3 volt it is given. V C 0 plus is equal to 3 volt, it is given. Now, switch is closed that means switch is closed right.

So, if is switch is closed and our (Refer Time: 01:14) to find out V C t. So, initial value of V C 0 known. We have to only find out there what you call that V C infinity. So, as switch is closed for long time. So, this is what you call this after long time this capacitor will act as open circuit, right.

So that means, if I make the circuit once like this, it is something like this hope it is understandable to you. This is 8 volt, right and this is 8 volt and this is your 1 kilo ohm, this is kilo ohm 1 kilo ohm and capacitor is connected somewhere here. This is open capacitor is open and then your 1 3rd kilo ohm right. And this is open and voltage across this is V C say plus minus, but this is open; that means, current will flow through like this. Because, at steady state or at in t tends to infinity, your capacitor I mean, switch in general. So, when switch is closed for long time, so, that we have to find out? The current, and then, you have to find out what is the voltage across the capacitor.

So, if it is. So, then first if this is the current, I say then I can put it say i infinity because, capacitor your what you call switch was closed for long time. So, it is 8 volt right; 8 volt it is kilo ohm right. It is kilo ohm. So, I will write like this 1 plus 1 by 3 as it is kilo ohm. So, it will be your milliampere; it will be milliampere right. So, it is 8 by 1 plus 1 so; that means, it is equal to actually 8 into 3 by 4 that is your 6 milliampere right.

So; that means, what is that you call V C infinity then. So, I am making it here for you, I am writing on it V C infinity will be this is your i infinity and this capacitor and this your what you call is this one third kilo ohm resistance as will connected across the capacitor. So, V C infinity will be i infinity that is your 6 milliampere right and this is your one third kilo ohm. So, it is volt.

So, basically, it is equal to 2 volt. So, V C infinity will be 2 volt right 3 6 2 volt right because it is 6 is your milliampere and this is kilo ohm so it is 2 volt. So, V C infinity is 2 volt. So, let us see right.

And time constant; one more thing is there time constant is also there, right. Time constant this is your close right and you have to find out your R Thevenin from this point only, at this point only. Because, capacitor is acting as open circuit right and this for getting R Thevenin, this voltage source will be shorted right.

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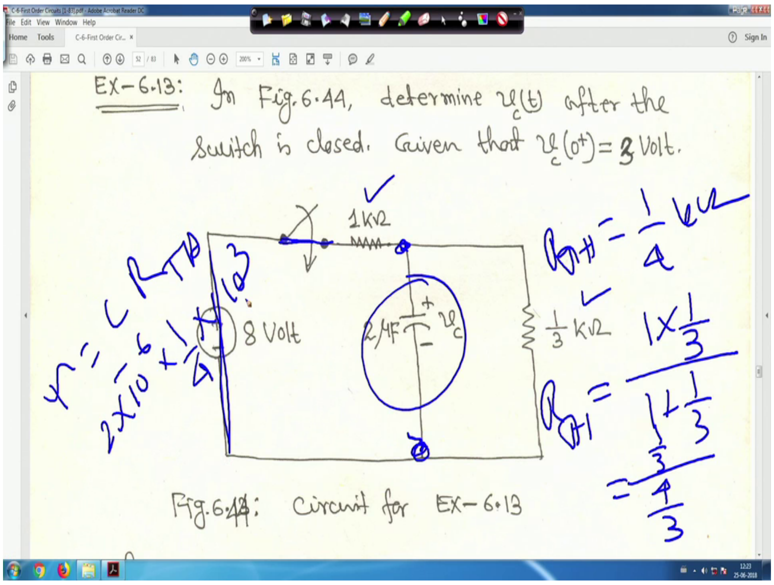

So, you will get R Thevenin right is equal to your 1 into 1 by 3; then, one this 1 kilo ohm and 1 3rd kilo ohm are in parallel, right, because, these are finding out from this point only so divided by 1 plus 1 by 3. So, it is 1 by 3 divided by 4 by 3, right. So, that is R Thevenin is equal to your 1 by 4 kilo ohm right and capacitor is 2 microfarad. So, time constant tau is equal to C R, R Thevenin, C R Thevenin.

So, it is 2 microfarad; that means 2 into 10 to the power minus 6 and this is into your 1 by 4 kilo ohm. So, 1 by 4 into 10 to the power 3 whatever it is coming calculation is shown later right. So, let me clear it.

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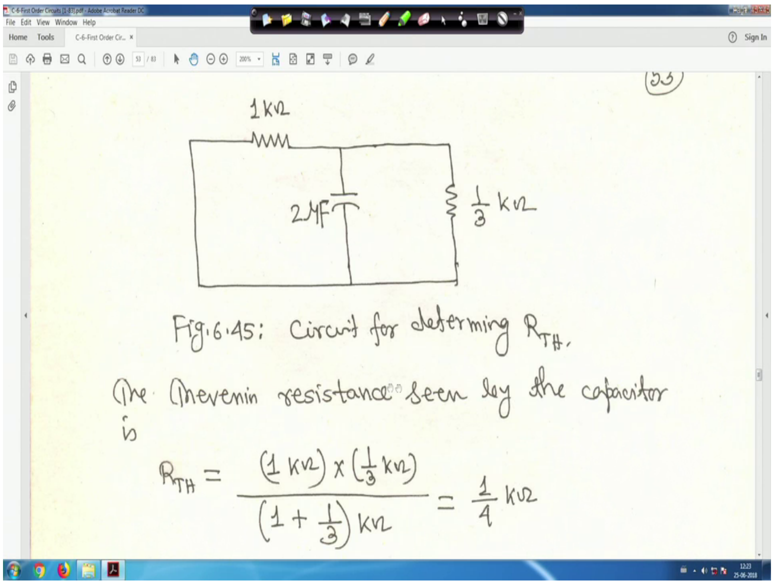

So; that means, this is the circuit. I told you I mean the way I told you right. So, R Thevenin is equal to 1 by 4 kilo ohm. I told you how to calculate it; everything is here, right.

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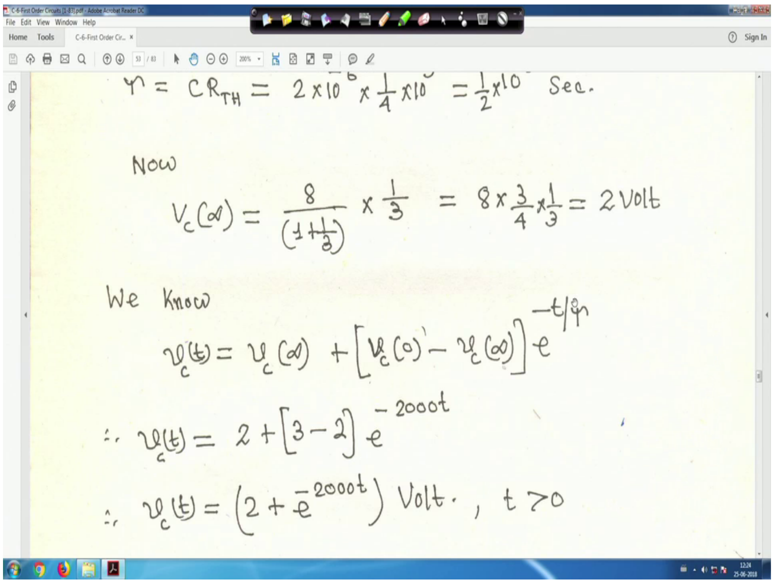

C R Thevenin, I just told you it will be half into 10 to the power minus 3 second right. And V C infinity also calculated for you, it is 2 volt that is also calculated, I calculated for you. And therefore, these use this standard formula that V C t generalized formula rather V C t is equal to V C infinity plus V C 0 minus V C infinity e to the power minus t by tau.

So, V C infinity is 2-volt V C 0 3 V C infinity 2 and e the power minus 2000, your t right. Substitute tau and you will get e to the power minus 2000 t. So, V C t will be 2 plus e to the power minus 2000 t volt for t greater than 0, right. So, this is answer.

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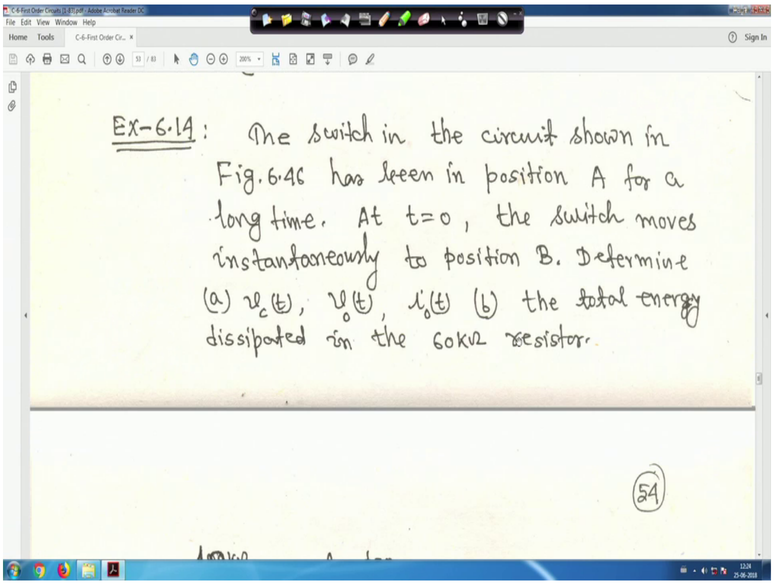

So, next is circuit, I will show you the switch in the circuit shown in figure 46 has been in position A for a long time.

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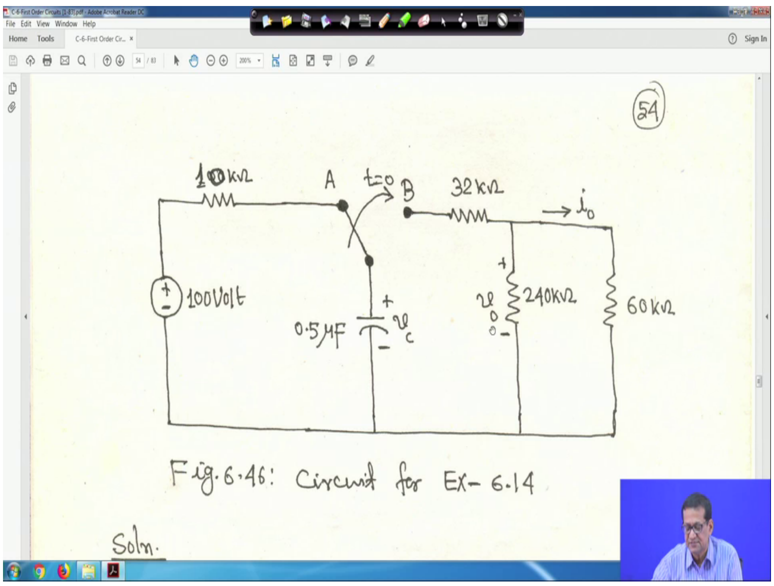

So, this is the circuit this was in position a for long time right at t is equal to 0 the switch moves instantaneously to position B determine V C t V 0 t i 0 t in part B the total energy dissipated in the 60 kilo ohm resistor right. So, the switch A this switch was in a position A for long time after that it move at t is equal to 0 it moves from A to B right. So, you have to find out V C t V 0 t i 0 t.

So, this is your V C t that is the voltage across the capacitor this is your i 0 t right and this is voltage across 2 40 kilo ohm resistor is V 0 t. So, all these things you have to obtain V C t V 0 t i 0 t. Now at switch in this position was for long time right.

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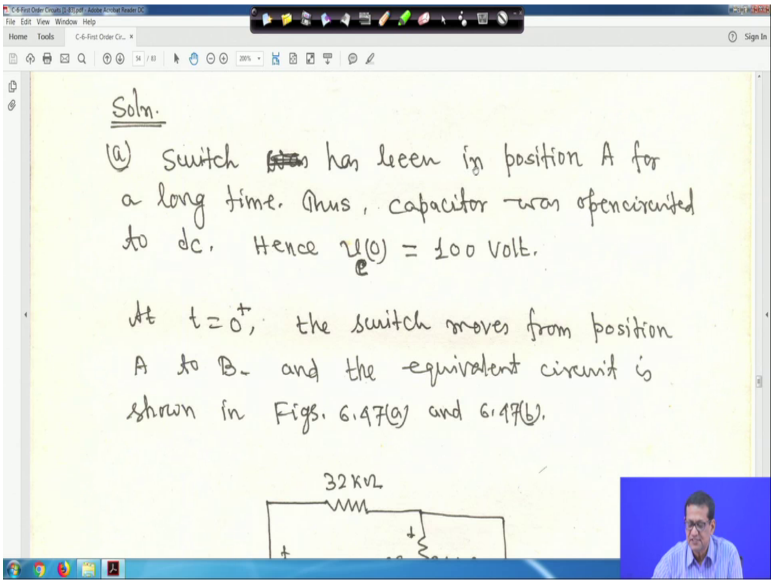

Switch has been in a position for long time the capacitor was open circuited DC as it was in the long position. So, capacitor here was open; I mean steady state for this part left hand side right.

So, capacitor was at open circuited. So, naturally V C 0 minus is equal to take 100 volt is equal to V C 0 plus because your voltage through a capacitor when switch move from position A to B it cannot change instantaneously. So, V C 0 minus will be 100 volt. Because, switch was at position a for long time; that means, capacitor is acting as a open circuit right, so directly V C 0 plus 0 minus will be 100 volt right. So, not saying again and again; it is understandable to you, right.

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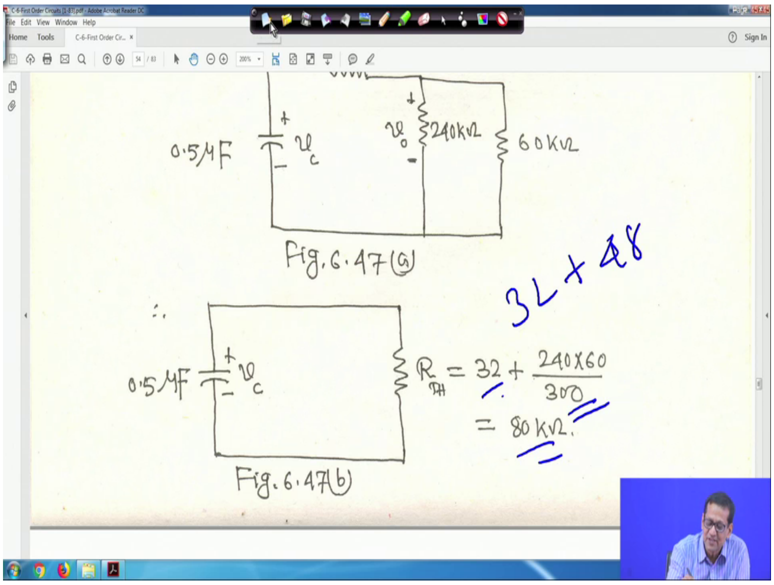

Now, at t 0 plus switch moves from A to B, that is your the switch actually moving from A to B and this is the circuit this 32 kilo ohm and 240 and 60 kilo ohm are in parallel right this 2 are in parallel. Now, as their equivalent will be that you are R Thevenin will be 32 plus 240 into 60 upon 240 plus 60 whatever it comes it is 80 kilo ohm, right and capacitor is 0; microfarad 5 microfarad. Therefore, tau is equal to C into R Thevenin. So, it is 0.04 second right.

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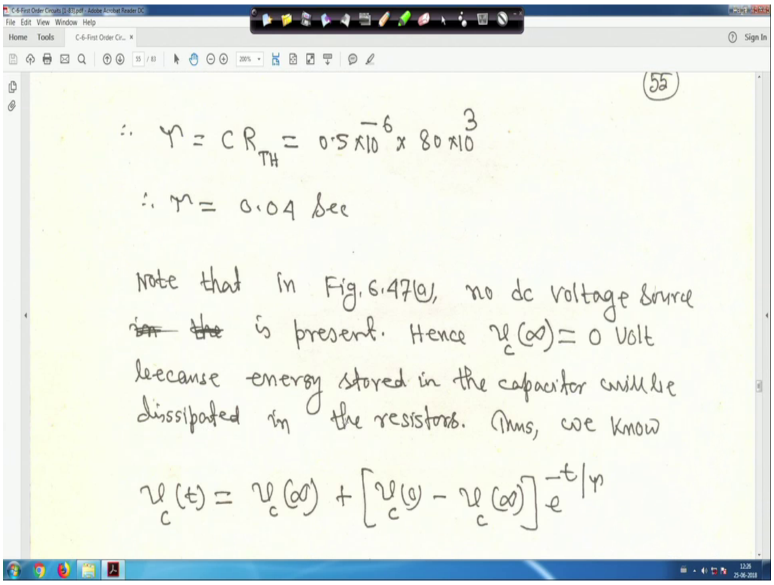

Now, in note that in figure say that if the DC voltage source is present right; in this figure, if here, if you look into that, it is a basically source free circuit; there is no source. Because, if you look into that, there is no and this capacitor is charged at your what you call at 100 volt right and when it will be and when it will be your what you call at t tends to infinity, that all the energy will be dissipated in the resistor. So, this is basically source free circuit; that means, V C infinity will be 0, because, there is no source in the circuit. It is a capacitor only. Initially, it was charged at 100 volt, right.

So, that is why you call that no DC voltage source is present. Hence, V C infinity is 0, right. Because, energy stored in the capacitor will be dissipated in the resistor. This circuit is something like a source free circuit, right.

So, in this case V C infinity will be 0. So now, we know that generalized formula say V C t is equal to V C infinity plus V C 0 minus V C infinity e to the power minus t by tau. So, V C t is equal to V C infinity is 0. So, that means, V C and V C 0 is equal to 100. So, V C t will be 100 e to the power minus 25 t volt for t greater than 0.

Now, if you come that V 0 t will be V C t by 80 into this thing. Now, if you come to the circuit that your V C t, now V C t is known. You have to find out your V 0 t. Now, question is that that, when we try to find out, look at look at this one right, we are writing V 0 t is equal to V C t upon 80 into 40 right. So, V C t V 0 t is equal to V C t upon 80 into 40 right.

So, if you look into what you call your if you look into this one your this circuit. So, these 2 are in parallel 240 into 60 and this is 32. So, R Thevenin is becoming your what you call 32 plus this one your 80 80 kilo ohm, but this total, but just hold on; this is actually, this is actually, 32 plus 48, right. So, this is 48 and this is your 32. Total is 80 kilo ohm.

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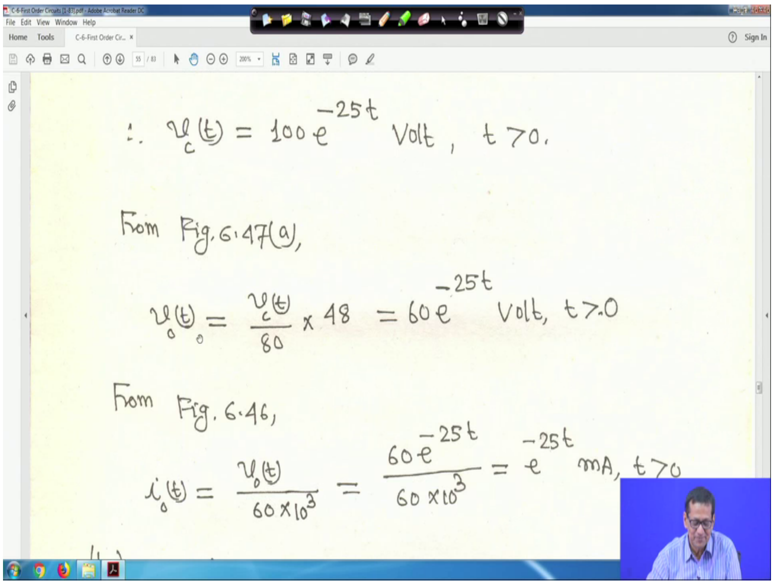

So, if you look into this, let me clear it. Now, if you look into this that this part, your V 0 t, it is V C t by 80 into 48. So, it will be 60 e to the power minus 5 t. So, little bit you do it this one. This part little I told you little bit you do it. So, it will be t greater than 0 and i t i 0 t will be V 0 t upon 60 upon this one. So, i 0 t that is your if you come to the original circuit, this is the i 0 t right. This is your 60 and when it is circuit is closed, when circuit is closed right, that this is. This is actually i 0 t. So, not shown in this figure, this is here, it is there. Here, it is i 0 and this capacitor this 240 60 all are in parallel. So, it will be V C t upon 60 kilo ohm right, your milliampere.

So, it will be your i 0 t will be V 0 t upon 60 it is into 10 to the power 3. Whatever it comes, it is e to the power minus 25 milliampere for t greater than 0. Now, total power dissipated in the 60 kilo ohm resistor is P 60 is equal to i 0 square t right into your R; that is R is 60 kilo ohm 60 into 10 to the power 3. That is, it is 60 e to the power minus your 50 t milliwatt, t greater than 0.

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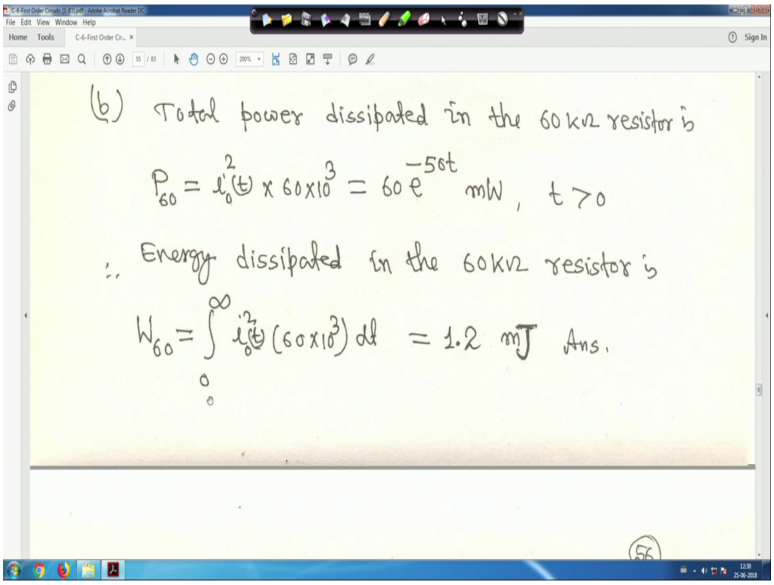

Now, energy dissipated in the 60 kilo ohm resistor is that, you have to take integration 0 to infinity right; so i 0 square t into R. If you integrate and simplify and i 0 t is known to you that e to the power minus 25 t, you put it here, you put it here and you integrate. You will get 1.2 millijoule. This is the answer, right.

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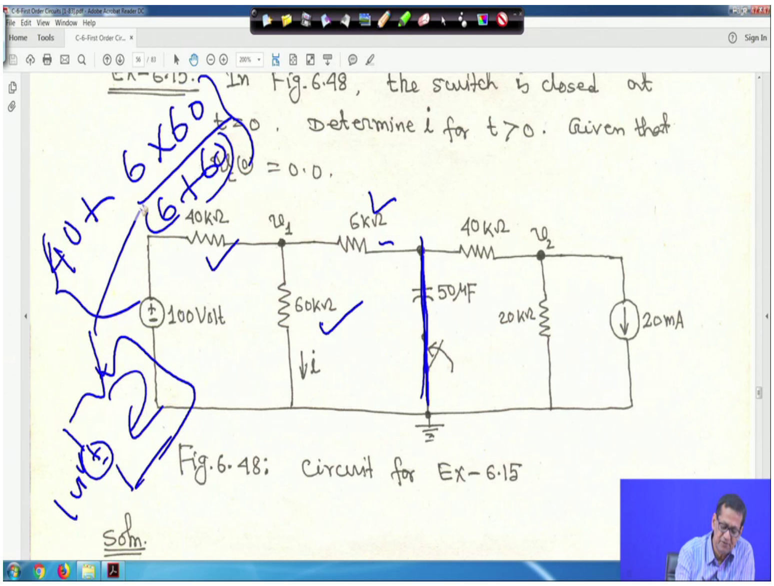

So, next, this one you take. In figure 48, the switch is closed at t is equal to 0. Determine i for t greater than 0 given that V C 0 is 0; that means, initially switch was open and initial values of voltage across the capacitor is 0. And you have to determine i for t greater than 0 when the switch is closed, right.

So, in that case, what will happen that your initially your what you call as soon as this switch is closed. As soon as you close the switch, that right, so, capacitor acts like a short circuit. That means a little bit understanding is required. Suppose, it is given that switch is that the switch is closed at t is equal to 0; that means, initially switch was open. Now, switch is closed at t is equal to 0 mean this is short circuit. If this is short circuit this 20 milliampere current, it has no effect on this one. Because, as it is a short circuit current will I am just, I am making it for you. The current will take path like this, right.

And as it is a short circuit, means this is this start this one, this one, this one, this one, everything is a common terminal. So, 60-ohm kilo ohm and 6 kilo ohm; they are in parallel, right. And in that case, in that case, we have to find out and here it is given that what is your V 1 and what is your V 2 that is this is nodal analysis is required.

So, as soon as soon as you close the switch right, so, there will be no effect on that initial your what you call on this your initial value of i. Because, it is a short circuit it is a short circuit right. So, I will come to that. So, that means, if you if you come to this at t is equal to short circuiting action of the capacitor, right.

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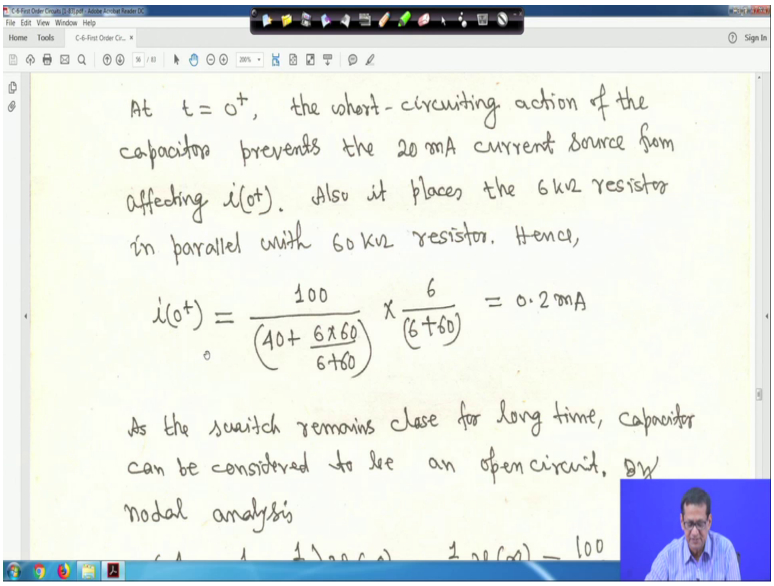

So, then what will be i 0 plus. So, this one, first you have to find look 100. Here you look, it is your what you call this your this is 100 volt, right. And this is actually first you find out the total current. How you will do it? Just 1 minute. Suppose this is short circuit; this is short circuit right, then 6 kilo ohm and 60 kilo ohm are in parallel right. With that, 40 kilo ohm are in series; that means, this 40 plus this 6 into 60 divided by your 6 plus 60; this is the total your what you call this is that your total value of the resistance, right.

Because, this is short; means this one this one are in parallel. Therefore, whatever it comes; that means, it will be ; that means, if I draw the equivalent circuit of this one, suppose, then I have only one, your 100-volt source and one resistance is like this, forget about this part. Just I am trying to make it this part, right.

So, in that case, the current is flowing and this value, this value is this value; that means let me clear it. That means this 100 by 40 plus 6 into 60 by 6. This is the current. This is what you call this is the current coming out from the source at the time of this thing right into 6 by then, current division will be there. Then, what will be the current through this? Let me clear it.

Then, this is the current and this is the current division right, current. We got 100 by 40 plus 6 by 6 into 60 upon 6 whatever come is milliampere right. Then, we want that what will be i 0 plus current division, then it will be for current division path it is multiplied by 6 divided by 6 plus 60 right. Your what you call that your current division path that whatever current will your what to call, your what you call that your current division path, right.

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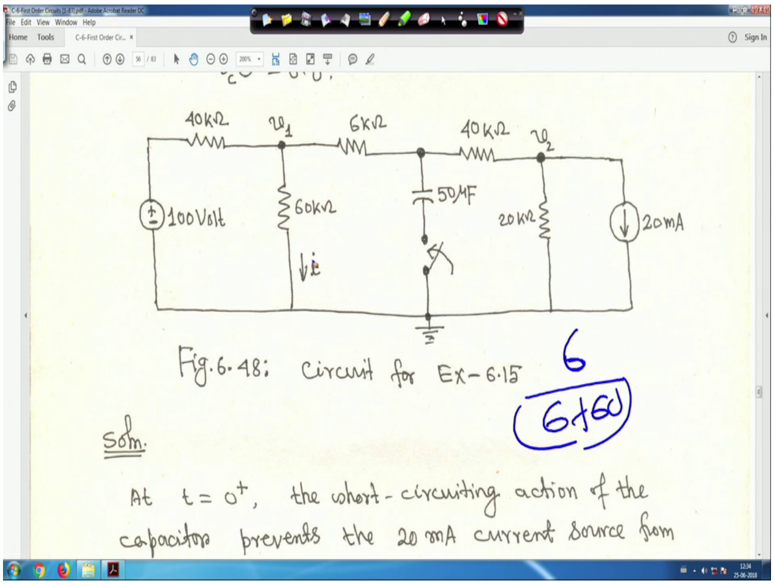

So, in that case, you have to make, just let me clear it. So, this is the total current; this is the total current to current division into 6 by 6 plus 60; that is your 0. This i 0 plus will become 0 by your 0 0.2 milliampere. I repeat again; I mean, I do not have much space here for drawing it; but, just let me tell you, making at on it hope, you will hope you will follow this is plus minus; this is my 100 volt, right.

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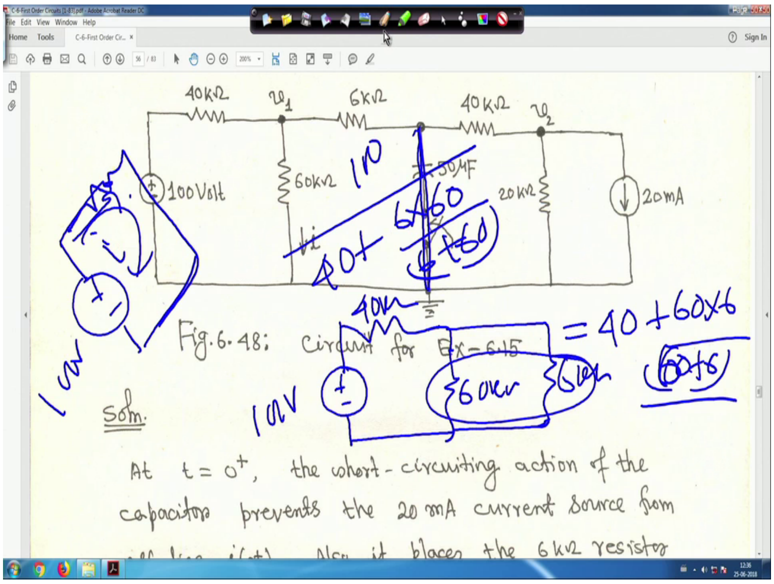

And this is my 40 kilo ohm right. And this way, as this is short and this is short this 2 are in parallel. So, if this is sort, then this is my 60 kilo ohm and this is my 6 kilo ohm right.

So, that mean, if you take the parallel of equivalent of this, this circuit will be your this is 40 plus 60 into 6 divided by 60 plus 6, right. Whatever it come, that is your and then, then the equivalent circuit of only this part plus minus this is 100 volt and this is that your resistance, right. Whatever it comes, so, this current you find out i. This is the total current coming from the source; this i this 100 divided by this thing; that means, 100 volt divided by 40 plus 6 into 60 divided by 6 plus 60. This is the total current i here, right.

So, once it is done, once i is known right, let me clear it. Once i is known, then this i this is the i 0 plus, we have to find out at that time just when switch is just closed i 0.

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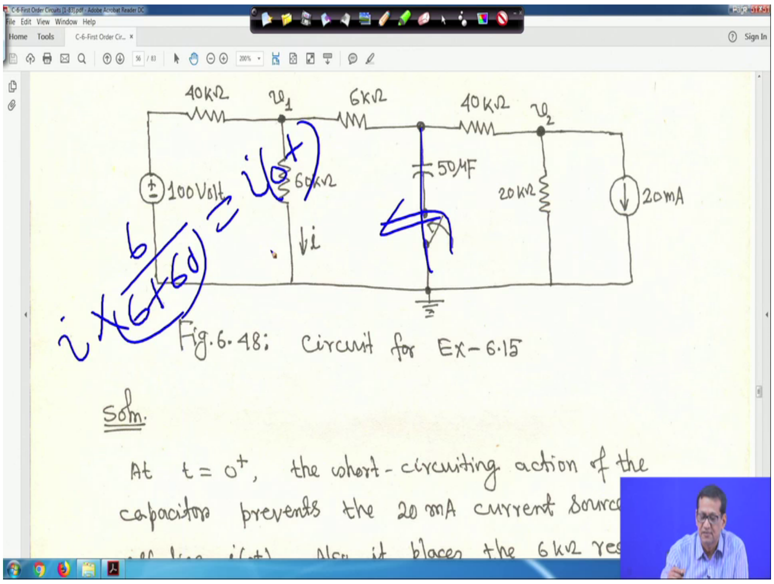

This means, this i; that is your total current i into this i 0 this is 6 and 60 are parallel. So, 6 current division 6 by 60 right that is equal to actually i 0 plus right. So, that is what actually to save time, I have directly made it. It is 0.2 milliampere right. Now, as the switch remains closed for long time, capacitor can be considered to be an open circuit by nodal analysis. So now, switch is closed for long time.

So, as now it is closed; that is instantaneous. We got it. Now, switch is closed for long time; that mean this capacitor is open circuited, right. It is open circuited. So, in that case, here as it open for that, this V 1 you can write as a V 1 infinity steady state.

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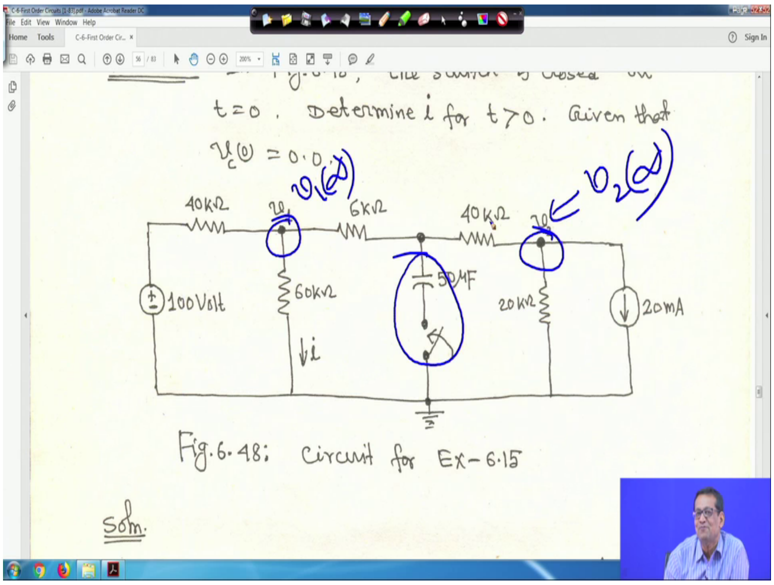

Similarly, this nodal analysis V 2, we have to apply it as V 2 infinity, right. So, that means, at steady state it is reached, switch was closed for long time. So, at this node, you apply for your nodal analysis KCL here also you apply for KCL. So, this we have studied much studied before. And so, many problems we have solved.

So, I am not just directly I am writing those equations right. So, in that case, if you write apply KCL.

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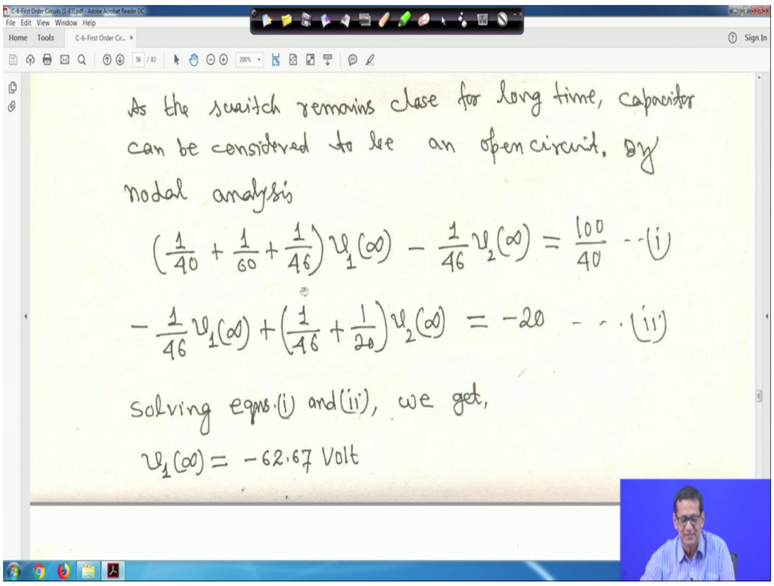

KCL at that 2 node and you will get 2 equation in terms of V 1 infinity and V 2 infinity this is one equation another equation you write of your own right. Many thing many things you have studied. So, no need to explain further. Just apply to that you will get those 2 equation and this is your, this thing solving equation 1 and 2, you will get minus 62.67. Remember, this voltage is taken is ok. And you are what you call this current 20 milliampere. It is in milliampere. This is milliampere and all are kilo ohm. So, that is why, it is milliampere and kilo ohm. That is why, 10 to the power 3 is not multiplied, right.

So, that is why it is what you call equation directly written like this and V 1 infinity minus 62.67 volt right. Therefore, i infinity will be V 1 infinity upon 60 kilo ohm that is 60 into 10 to the power 3. If you come to this i infinity, this is i at steady state right. So, if you know that what you call that you are V your what you call V 1 infinity and V 2 infinity, these are the 2 nodal voltage. So, i infinity will be V 1 infinity upon 60 right. So, that is why, it is written i 1 infinity is equal to 60 kilo ohm. So, it is minus 1.04 milliampere.

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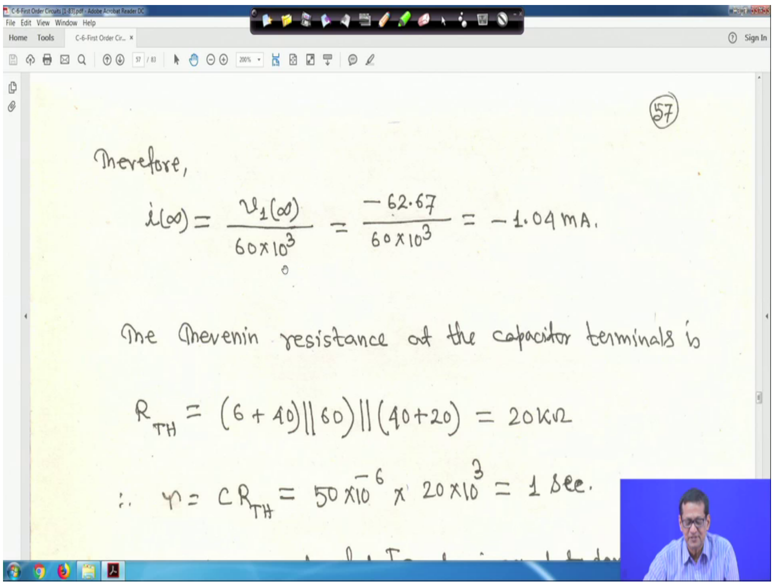

Now, the Thevenin one correction I have to make it here. Now, the Thevenin resistance at the capacitor terminals are now here to find out the transient response; you have to find out that R Thevenin right. So, across these 2 you have to find out what you call that

R Thevenin. So, R Thevenin means, this is short and this will be open circuit. This should not be there.

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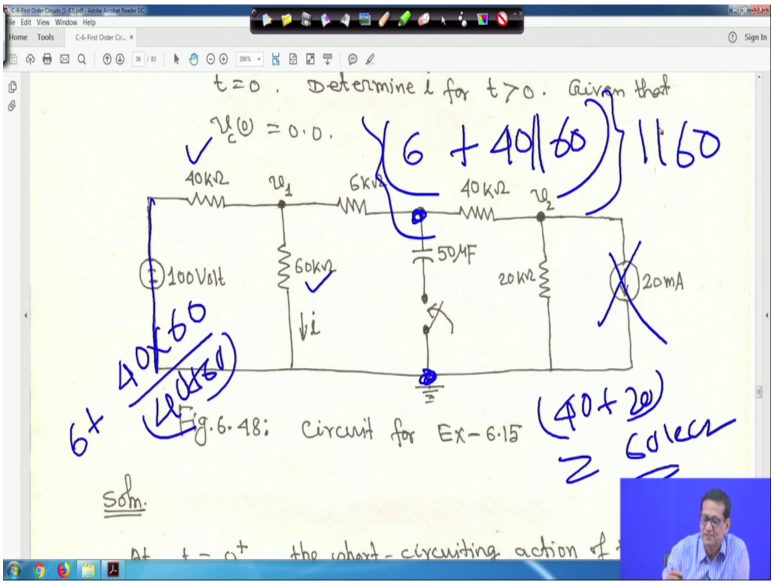

So, right hand side, it will be 40 plus 20; that is your 60 kilo ohm right. This is under because, this you want to find out R Thevenin. So, this should be gone this is open circuit. This is short circuit and this side as it is short circuit. So, 40 kilo ohm and 60 kilo ohm are in parallel with that 6 kilo ohm is in series; that means, left hand side, I mean this side, it will be your 6 plus 40 into 60 divided by 40 plus 60 right, this side.

That mean, this side we can write it will be 6 plus that your 40 parallel to 60. It is this side right. So, this side this one and this side and all these combination is parallel to your this 60, this 60 and we will calculate equivalent your what you call R Thevenin, right. So, here, in that here it is one what you call one writing error is there.

So, in this here, correction is I wrote there that this bracket should not be there. So, 6 40 and 60 are in parallel with that 40 plus 20, whatever it comes 20 kilo ohm right. So, this is a correction right. So, tau is equal to C R Thevenin. So, it is becoming 1 second. So, using the relationship, you have you have to it is written that if that is asked to derive this right.

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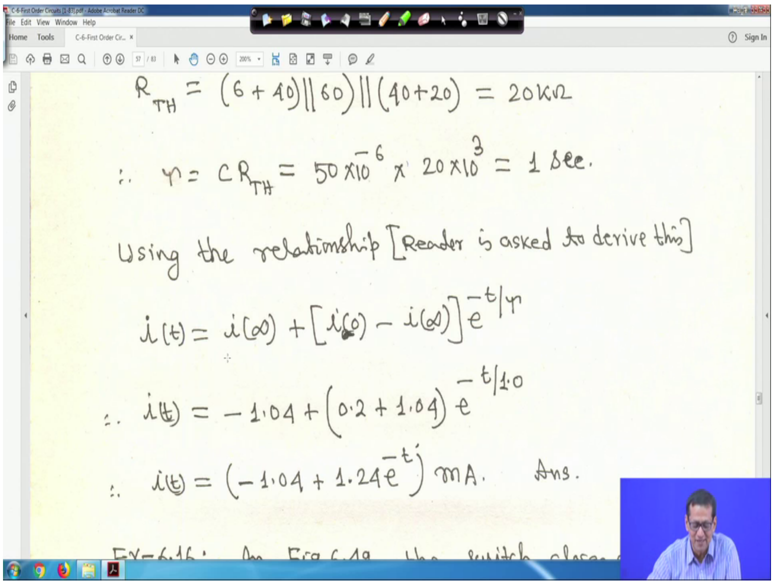

So, let me clear it. You will derive it, but directly we are writing i t is equal to same generalize expression for the current also. i infinity plus i 0 minus i infinity e to the power minus t by tau. So, i infinity we have calculated minus 1.04 I 0 you have calculated 0.2. These are all milliampere, right. And it is i infinity is minus 1.04. So, it will be plus 1.04. So, it is coming i t is equal to minus 1.04 plus 1.24 e to the power minus t milliampere. This is what you call 40 greater than 0. This is the answer for i t right.

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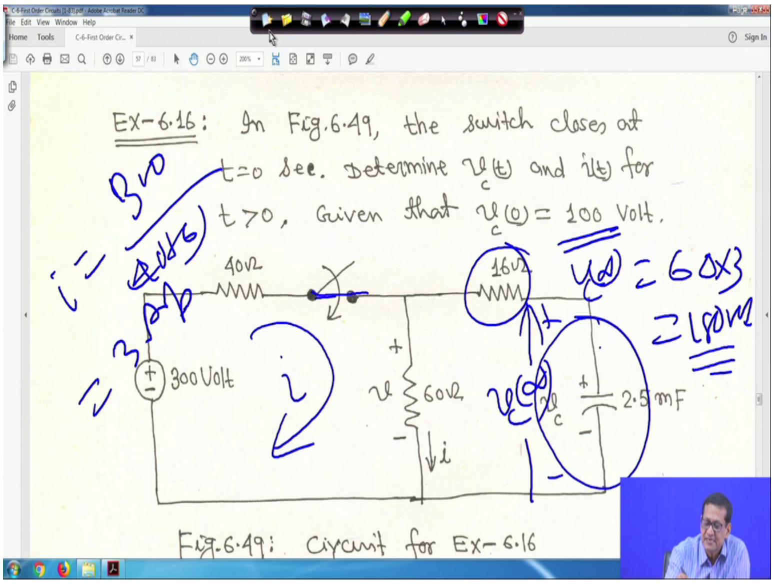

The another one is that with figure 49, this switch is closes at t is equal to 0 second this is the switch closed at determine V C t and i t for t greater than 0 given that V C 0 is 100 volt. So, this is V C the capacitor is there. Initial voltage is given right; that is V C 0. Initially, switch was your what you call switch was open. Now, as soon as you as soon as you close that switch right, as soon as you close the switch and suppose you have to find out 2 things; one is what is V C infinity, now, before going for the solution, so, this switch is closed. This switch is closed right. And it suppose this switch is closed for long time.

So, this capacitor will act as open circuit right; that means, voltage across the capacitor say, we can write V C infinity right; say we can write V C infinity. Because, capacitor it is 22.5 millifarad right. So, in that case, what will happen this capacitor? If this part is open, this part is open. So, first you find out what is the current, right. So, i if this is i i is equal to 300 divided by 40 plus 60 right. So, is equal to 3 ampere right, then this 3 ampere current is flowing through this and V C infinity is nothing but the V; because voltage act was this is resistor 60, right.

So, V C infinity because this is this side is open. So, nothing is flowing there right. So, V C infinity is equal to 60 into the current 3 is equal to 180 volt. Initial value was given V C 0 and V C infinity. The final value steady state value is 180 volt right. Next, what we have to do is, we have to find out the time constant of the circuit. Now, let me clear it. So, as this is open, as this is the capacitor terminal, we have to find out the equivalent resistance Thevenin team. So, this is shorted right; so 40 into 60 parallel.

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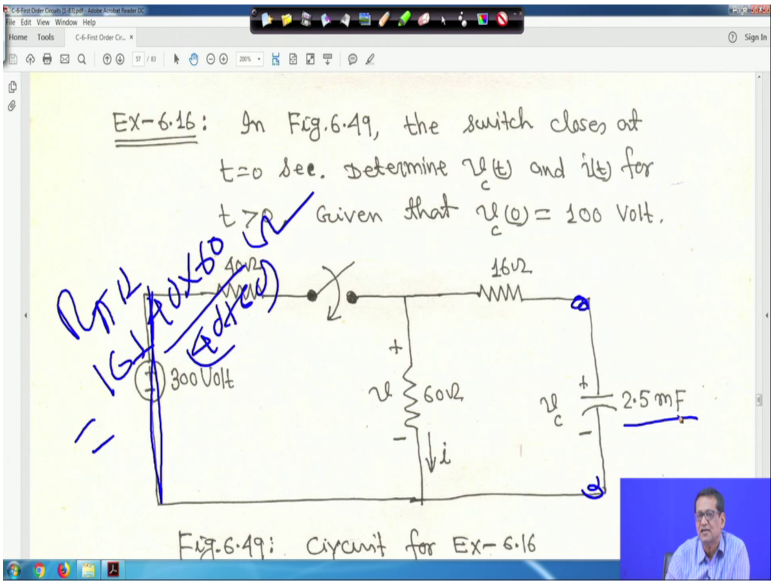

So, R Thevenin is equal to your 16 plus this 40 into 60 divided by 40 plus 60. Whatever it comes this much of it is ohm, so this much of ohm.

And C is given 2.5 millifarad. So, tau is equal to C R Thevenin, you can easily compute, right. So, let us go to this thing.

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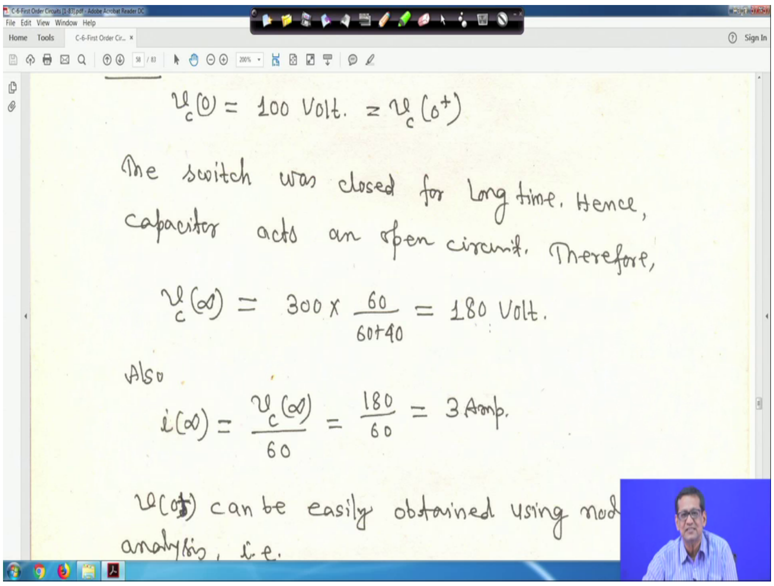

So, in this case, V 0 is given that is V 0 plus and V C infinity. I told you it is 180 volt. We calculated and i infinity also we calculated 3 ampere right. And therefore, V 0 can easily be obtained using nodal analysis; that means, suppose, this V 0 i mean this V you have to

I mean here. So, V 0 also one can your this voltage across this one it can be obtained your from nodal analysis. So, here you have to apply KCL. And this point voltage is 300 volt and this initial voltage was V C 0 what you call 100 volt.

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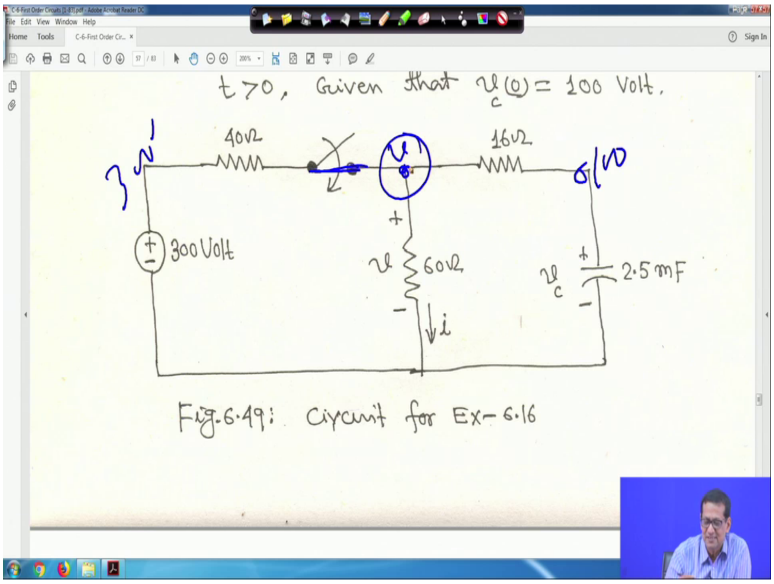

So, at this point, you apply the nodal analysis. Suppose the way you take the direction of the current and accordingly you apply KCL at this point right. So, that has been done here. So, at the time of switch is closed, right.

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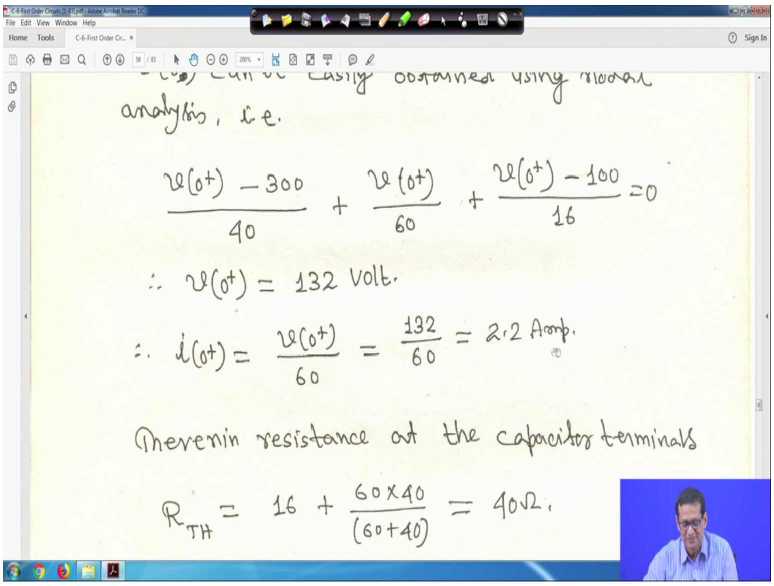

So, at that V 0 plus can easily we obtain using nodal analysis is a V 0 plus minus 340 that current is actually leaving the terminal plus V 0 plus upon 60 plus V 0 plus minus 100 by 16 is equal to 0. All current actually are leaving. So, that is why, all sum it up right and if you solve this V 0 plus 132 volt right and i 0 plus is equal to from the circuit only V 0 plus by 60; so 2.2 milliampere.

Now, R Thevenin is equal to 40 ohm. Whatever I told you tau is equal to you will get 0.1 second and V C t will be your V C infinity. I calculated for you 180 volt and V C 0 is given 100 volt and tau we calculated 0.1 second so, t by tau.

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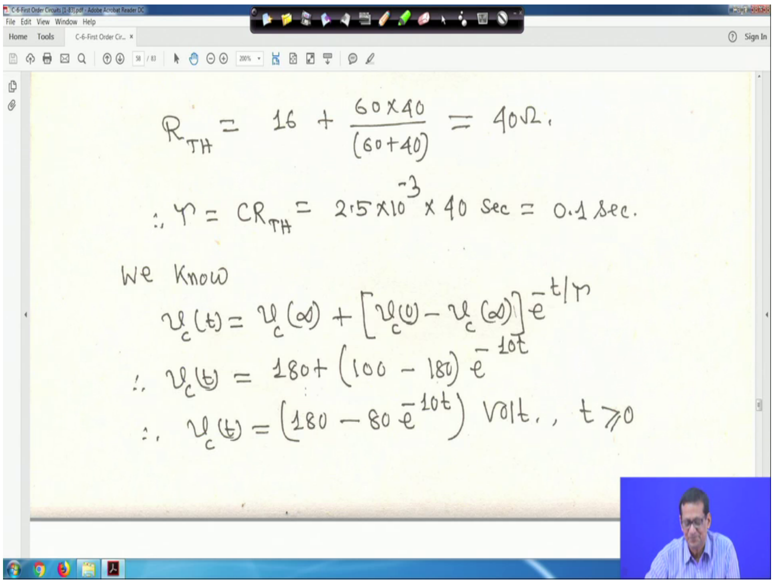

So, it is e to the power minus 10 t. So, it is V C t is equal to 180 minus 80 e to the power minus 10 t volt; that is t greater than equal to 0, right.

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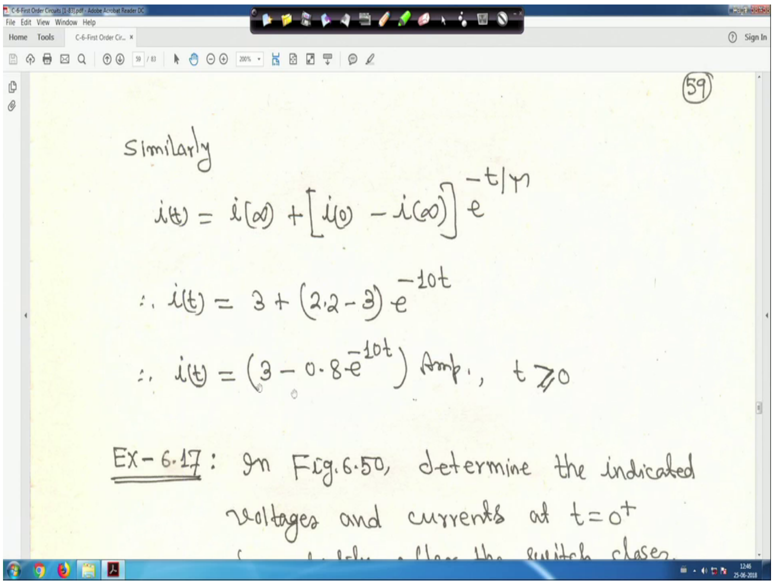

Similarly, for i t is equal to i infinity plus i 0 minus i infinity e to the power minus t by tau, right. So, i t is equal to 3 plus 2.2 minus 3 e to the power minus 10 t. So, i t is equal to 3 minus 0.8 e to the power minus 10 t ampere for t greater than 0 right. So, this are this is a you know little bit coming to this problem diagram, little bit you do it and just see that only that little bit understanding is required.

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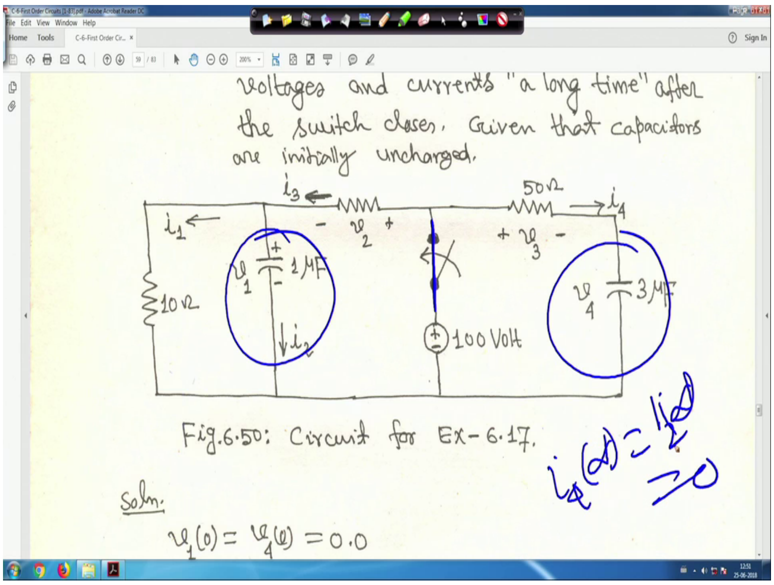

So, next one is next one is this is this is very interesting problem. So, figures 50 determine the indicated voltages and current at t is equal to 0 plus immediately after the switch closes also, find these voltages and current a long time after the switch closes given that capacitors are initially uncharged. This is the circuit which is given that as soon as the switch is closed, what will be the value of i 1 0 plus V 1 0 plus i 2 0 plus V 2 0 plus V 3 0 plus i 4 0 plus and V 0 V 4 0 plus another thing is another thing is that the switch is closed for long time, then what will be their values; that means, steady state values.

Now. So, initially switch was open switch was initially switch was open. Then it is closed right. So, if you if that the switch was initially open right and capacitor that your charged capacitors are initially uncharged right, so; that means, V 1 0 is equal to your V 4 0 is equal to 0. Then, voltage across this 3 microfarad capacitor is V 4. Here, it is and here it is V 1 right. So, initial it was uncharged. So, V 1 0 V 4 0 is equal to 0. Now, with 0 volt across the capacitor, they act like a short circuit this one, this V 4 and V 1. These 2 capacitors they act like a short circuit right.

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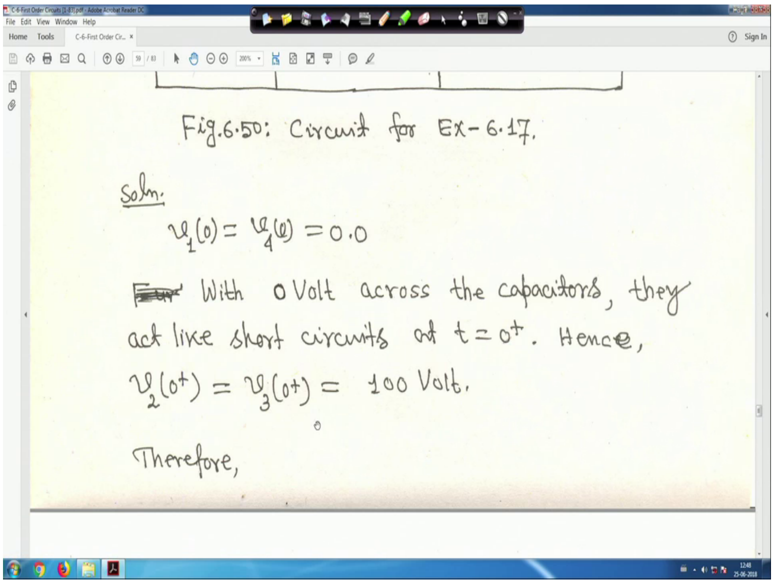

Therefore, hence the V 2 0 V 3 0 is equal to 100 volt right; that means, suppose if it act like a short circuit, if it is a act like a short circuit right suppose this is a short circuit and as soon as what you call that switch is closed right. So, at that time, if it is a short then V 2 your what you call the V 2 0 and V 3 0 will be is equal 100 volt, because, nothing is here. It is a short; nothing here it is a short right. So, V 2 0 plus and V 3 0 plus will be is equal to 100 volt. So, let me clear it.

So, that is your 100 volt right. Now, therefore, i 1 0 plus will be; that means, i 1 0 plus. So, this is your i 1 this is short; that means, V 1 0 plus is 0. So, i 1 0 plus will be 0 by 10. So, it is your 0 ampere. Now, i 3 0 plus this is your i 3 0 plus it is your what you call voltage here it is actually one data is missing; this value this value is 25 ohm right, this is 25 ohm. That is that to a voltage across 25 ohm is V 2 this is 25 ohm. So, i 3 0 plus will be 100 by 25, then because this is sort right. So, let me clear it.

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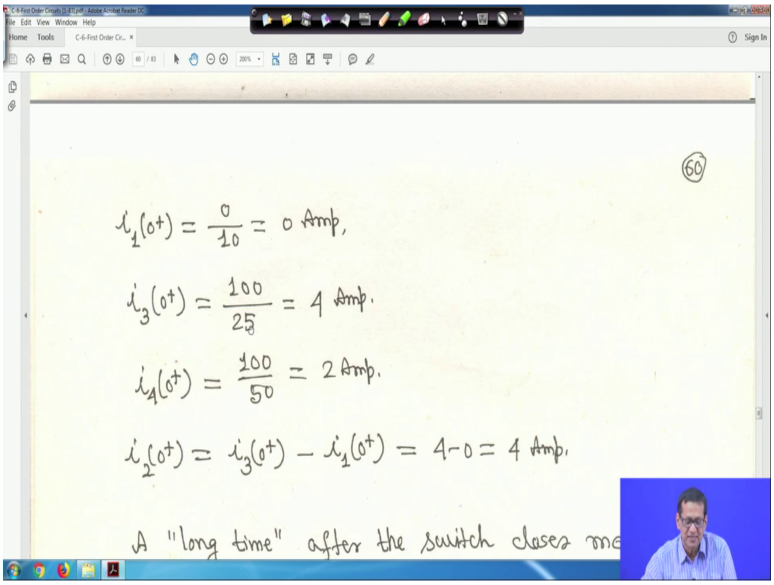

So; that means, that means it is 100 by 25 4 your ampere. Similarly, similarly for this one also this capacitor that V 4 this is short and voltage at as soon as switch is closed, that this is short and it is closed. So, it will be your 100 by 50. So, it will be your 100 by 50; that is your 2 ampere, and now, if you apply if you apply your KCL, if you apply KCL at this node, at this node if you apply KCL, so, i 3 0 plus is equal to i 1 0 plus plus i 2 0 plus you apply KCL at this node if you do. So, if you do. So, if your therefore, i 2 0 plus will be i 3 0 plus minus i 1 0 plus that is 4 minus 0 4 ampere.

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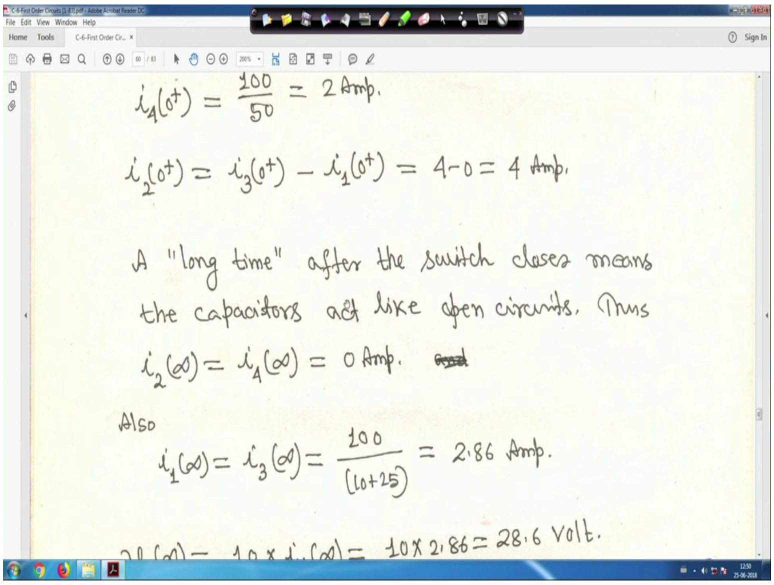

Now, second thing is, the steady state a long time, after the switch closes, means the capacitor acts like open circuit right. So, in this case, what will happen that switch is closed for long time this switch is closed for long time. At that time, this capacitor will act as open circuit and this capacitor will act as open circuit; that means, i 4 infinity is equal to i 2 infinity will be 0, because, it is open circuit. So, i 4 infinity the steady state value is equal to i 2 infinity is equal to 0 because capacitor act as an open circuit. So, let me clear it. So, it is what you call i 2 and i 4 into 0.

Now, also i 1 infinity is equal to i 3 infinity. Now, if you come this thing i 1 infinity and i 2 infinity, right; now, as this is as this is open, as this is open and this is also open right and in that case, you have to find out that your i 2 infinity and i this is open. So, nothing is flowing through this. Nothing is flowing through this and this is open means, i 3 is equal to i 1.

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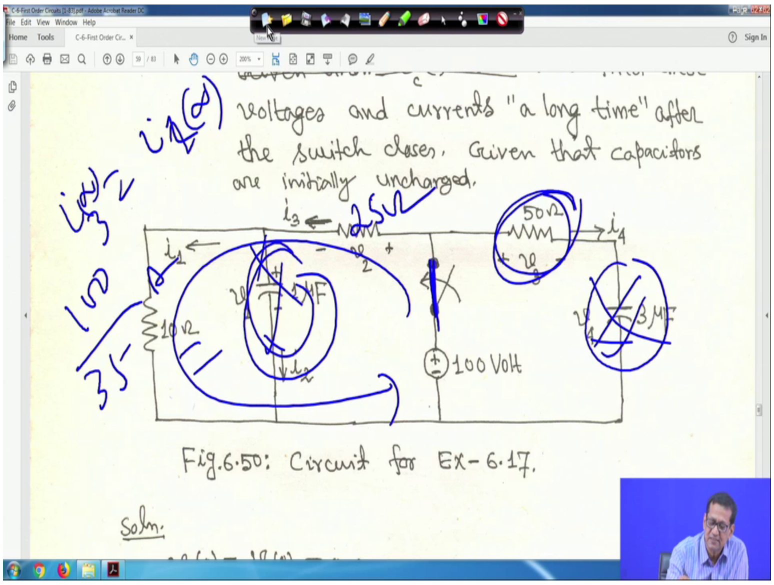

Because, this is open right; that means, i 3 and i 1. So now, this is open means, it is not there. It is open means, assume it is not there. It is open right and this is your close. So, in that case, it will be 10 ohm and I told you, here it is 25 ohm right, this is missed actually. So, current through this that i 1 this will be is equal to 100 divided by 25 plus 10 35; that is I 3 infinity is equal to i 1 infinity this is 100 by 35 ampere. Whatever it come right, because this is open, this is open.

So, no current is flowing here also and this is closed right. And only thing is that, this is the circuit and this is the circuit, this is the current flowing right. This is plus minus 100-volt terminal is given right. So that means, this is your what you call i 1 infinity is equal to this one. After that, I am not going to circuit; very easy to understand.

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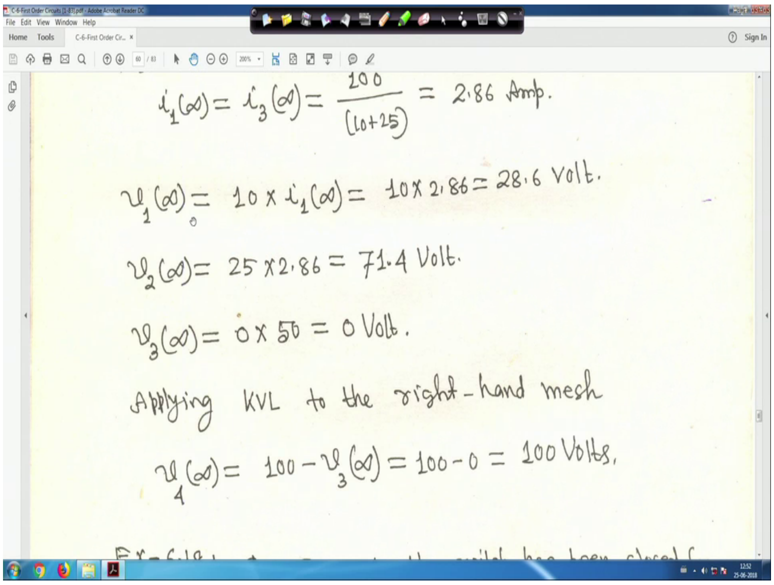

V 1 infinity will be just 10 into i 1 infinity 28.6 volt look at the circuit and do it V 2 infinity will be this 25 ohm across 2 is that I corrected it was not there in the original diagram, but 25 ohm is there right. So, 25 into 2.86 71.4-volt V 3 infinity 0 into 50 0 volt and applying KVL on the right hand mesh, you apply KVL on the right hand mesh, just do it know at steady state, you will get V 4 infinity is 100 minus V 3 infinity so it is 100 volt.

Thank you very much. We will be back again.