**Fundamentals of Electrical Engineering**
**Prof. Debapriya Das**
**Department of Electrical Engineering**
**Indian Institute of Technology, Kharagpur**

**Lecture – 08**
**Basic Laws (Contd.)**

So, welcome to this you know further some problems. So, by varieties of problem in circuit, if we see that then your understanding will be much more clear.

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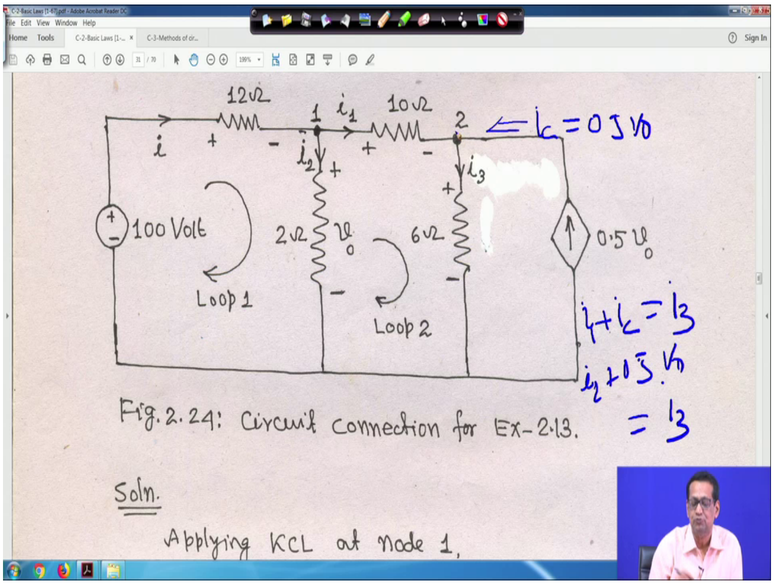


So, for this circuit, if you look into the circuit we have to find out actually i and i and your v 0, right. So, this I you have to find out and v 0, and this is your i, this is your i, is here, this is this is your i, right. And this voltage v 0 actually here it is here it is marked, this is your v 0, this is across your 2-ohm resistor, right?

And this is the circuit is given, it is the series power circuit and this is a current source, this is a dependent current source, and this current is 0.5 v 0. So, for your understanding this current say this is a current source, say actually ic is equal to if you want you can write say ic is equal to 0.5 your v 0. So, just it is shown 0.5 v 0 and you have to find out what is the i and what is the v 0, these are dependent current source, and you have to solve this circuit.

Now, how we will do it? There is a this is a 12-ohm resistance here. And this is your this is 12-ohm resistance, they are 2 ohm, here it is 10 ohm, and here it is 6 ohm, right. And voltage is voltage source is 100 volt, and current source one dependent current source is there current is equal to there is a 0.5 v 0, and this voltage actually is v 0 that is the across 2-ohm resistor.

And there are 2 loop, this is loop 1 clockwise direction we have taken and this is another loop 2, right. So, in this case, what you have what you have to do is that you have to just hold on, you have to your you have to solve this one, right. So, first what you do we apply KCL at node 1. Suppose if you apply KCL here, that is at node 1 this is your node 1, right. So, here the incoming current is i, this current is i and at node 1 are 2 2 are outgoing current, one is i 1, another is i 2 this is your node 1, right.

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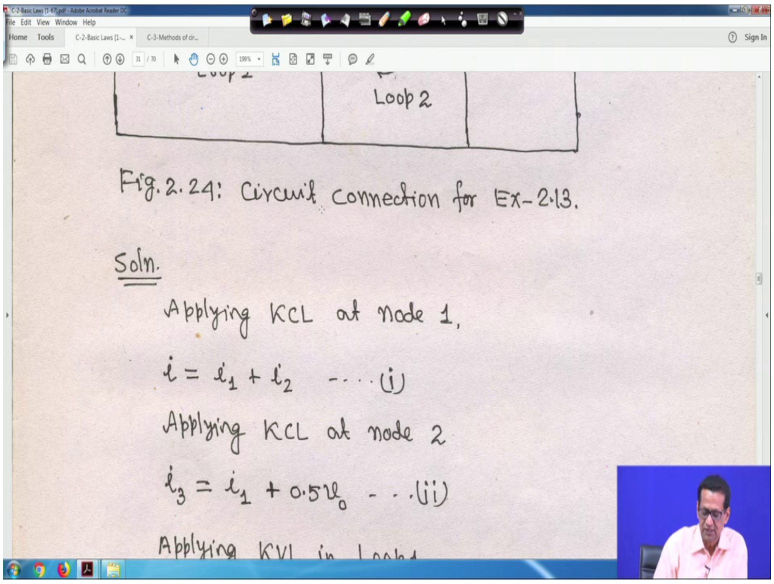


So, i is equal to i 1 plus i 2 so, after KCL at node 1 if you apply that i is equal to i 1 plus i 2, this is equation 1, now similarly you go to the circuit this is your node 2. So, and here just for your just for your understanding. So, this is your this is we said this current, we said know i, i your what you call ic. So, this is a dependent source that is i actually current is 0.5 v 0 0.5 v 0.

So, here if you apply KCL at node 2 so, basically 2 2 currents are incoming current, that is your i 1, i 1 plus this ic, right is equal to the outgoing current is equal to i 3 right; that means, your; that means, this is your i 1 and this is ic is actually 0.5 v 0 is equal to your i

3, right. So, if you apply your KCL are at node 2, right. So, let me make it just this thing. So, if you if you see here, that same thing we are writing that i 3 is equal to i 1 plus 0.5 v 0, right so, this is equation 2.

Now, we apply KVL in loop 1. So, this is your this is your loop 1, right. You are moving your what you call clockwise. So, first you are encountering the minus sign of this 100 voltage source, 100-volt voltage source. So, it will be minus 100, then plus your this current is this 12-ohm resistance, that a current is your flowing through this 12-ohm resistor is i so, plus 12 i, right. And here also this your what you call this branch, right at that i 2 is entering into this.

So, basically we can write either 2 into i 2 or plus v 0. So, in this case so, what we have done it that your in the loop 1, loop 1 that minus 100 plus 12 by plus your v 0 is equal to 0, right. Actually v 0 is equal to if you look into the circuit v 0 is equal to that from ohms' law 2 into i 2 current entering into the positive terminal so, v 0 is equal to 2 into i 2. So, this is your what you call that in loop 1 that is your KVL in loop 1, right this is loop 1.

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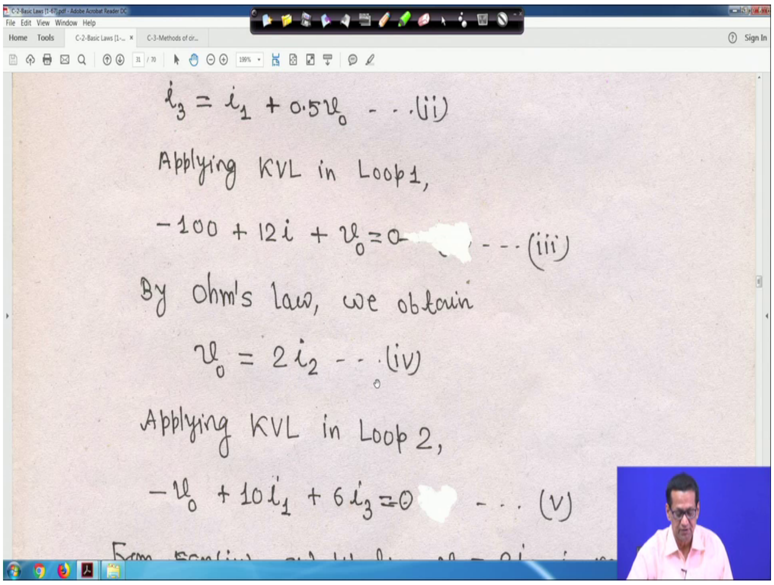


Now, by ohms' law also v is v 0 is equal to 2 i 2 now apply KVL in loop 2. So, here when we are applying KVL in the loop 2, thus it is you are moving in the clockwise direction. So, it is encountering first is minus sign of this your this v 0 that plus minus that v 0 is marked. So, and voltage across 2-ohm resistance is v 0. So, this encountering a minus sign first, it will be minus v 0, plus that it will be from it will be 10 into i 1, right. Then plus your, it will be 6 into i i 3, because current through this branch is i 3 is equal to 0.

So, if you come to this that, this is minus v 0 plus 10 into i 1 plus 6 i 3 is equal to 0. So, this is equation 5, right. Now from equation 4; that is, from this equation that is your v 0 is equal to 2 i 2 from this equation, right that you substitute this in equation 3 and equation 5; that means, here in the equation 3 v 0 is equal to substitute your what you call you substitute here v 0 is equal to 2 i 2. Similarly, here also in equation 5 you will substitute v 0 is equal to 2 i 2, right?

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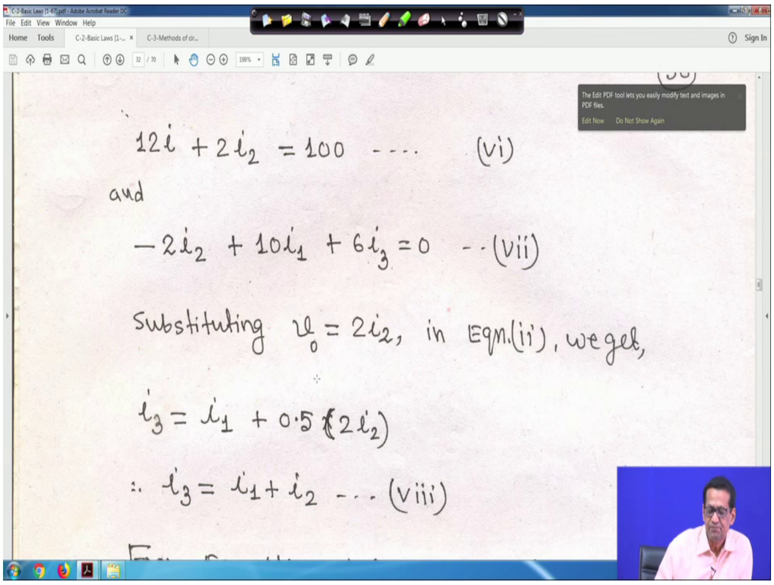


If you do so, you will get the 12 i plus 2 i 2 is equal to 100 this is your equation 6, and another one you will get minus 2 i 2 plus 10 i 1 plus 6 i 3 is equal to 0, this is equation 7. Now we know sub that v 0 is equal to 2 i 2, right. So, v 0 is equal to 2 i 2 you substitute in equation 2; that is, you are this is your equation 2, right. This is your equation 2. So, these equation you substitute v 0 is equal to 2 i 2 this equation you substitute, right? If you do so you will get your i 3 is equal to i 1 plus 0.5 v 0 and v 0 is equal to 2 i 2.

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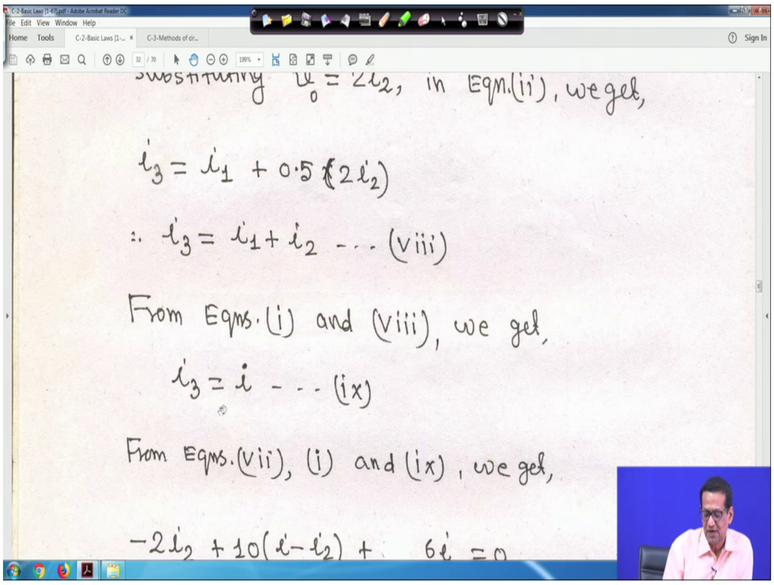


So, it will finally, become i 3 is equal to i 1 plus i 2 this is equation 8. Now from equation 1 and 8 just you will get i 3 is equal to i, because i 1 plus i 2 is equal to actually i we have seen before just check equation 1. So, i 1 plus i 2 is equal to i therefore, i 3 is equal to i, this is also I have marked as equation 9.

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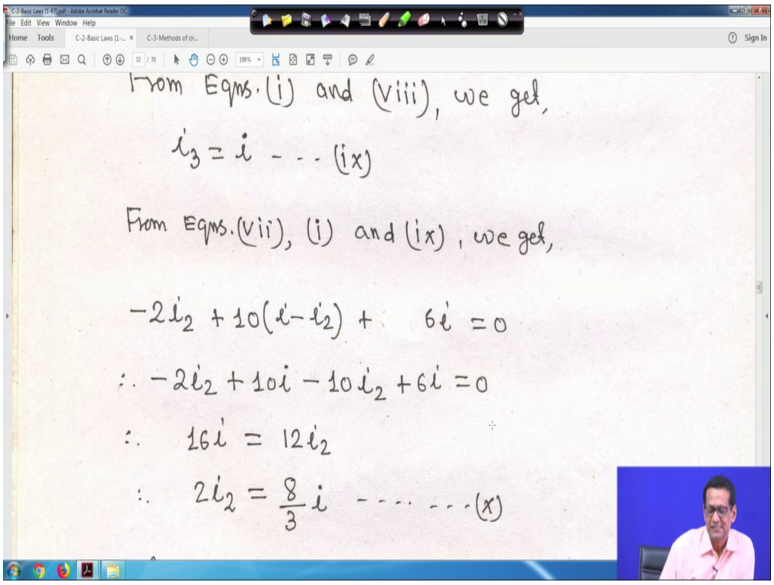


So, from equation 7, 1 and 9 we get so, what you do? You substitute all this thing this is very simple thing I am not repeating this, just from equation 7, 1 and 9 you will get just substitute all these thing, you will get all minus 2 i 2 plus 10 into I minus i 2 plus 6 i is equal to 0, right. Or upon simplification, right upon simplification, you will get that 2 i 2 is equal to actually 8 upon 3 i, right 16 i is equal to 12 i 2 so, 2 i 2 is equal to 8 upon 3 i.

So, actually v 0 is equal to 2 i 2, that is why I didn't write i 2 is equal to 4 by 3, I just 2 i 2 is equal to i 3 i, this is equation 10. Now solving equation 6 and 10 we get. So, if we just 2 i 2 is equal to 8 3 8 by 3 i. So, just solve equation 6 and equation 10, you just please do it, right. It is simple thing so, just solving 2 linear equations, you will get i is equal to 75 by 11 ampere, and i 2 you will get 10 upon sorry 100 upon 11 ampere.

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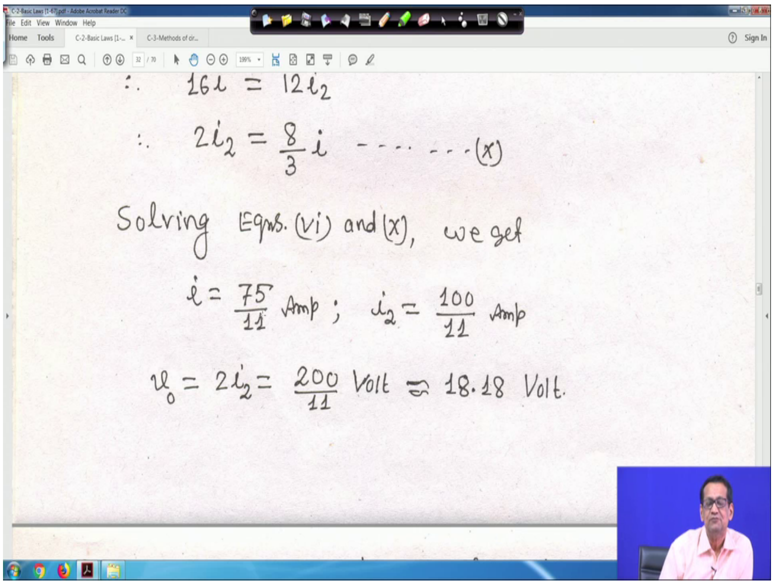


And v 0 is equal to you know 2 i 2 so, 2 actually and 2 i 2 so, 2 into your, what you call and i 2 you have got 100 by 11. So, it is 2 2 100 by 11 volt is equal to approximately 18.18 volt. So, this is your i ah; that means, this is your this is your i 75 by 11 ampere and v 0 is equal to approximately 18.18 volt, this is the answer, right.

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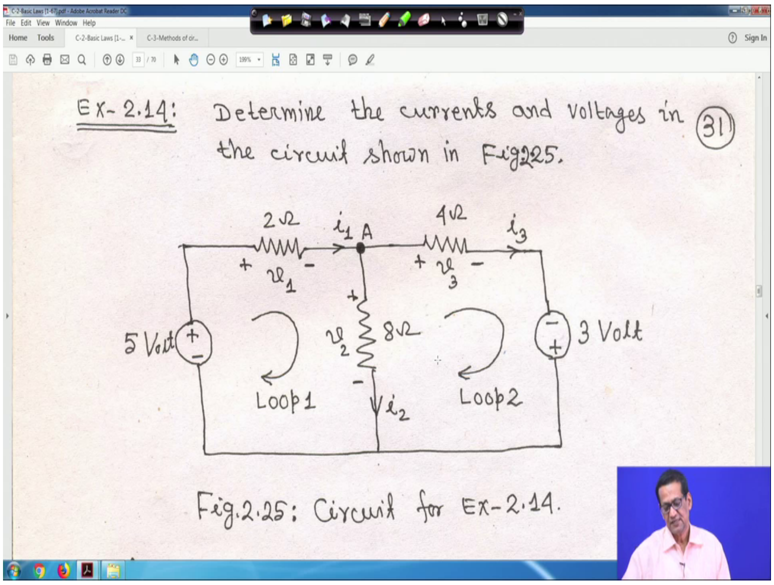


Next take another example. So, you should you should be familiar with all sort of numericals. So, second one is that another one is that determine the currents and voltage your in the circuit shown in figure, this your 2.2 5, right. So, it is your here no question of any your dependent source, 2 independent voltage sources are there. One is 5 volt, one is minus 3 volt, right. And 2 loops are there, that taken in a clockwise direction and across 2-ohm resistance the voltage is v 1, across 4 ohm it is v 3, across 8 ohm it is v 2.

And you have to you have to your what you call you have to find out the current and voltage is in the circuit; that means, you have to find out your i 1 I this current through this branch is i 1, this is here it is i 2 and here it is your i 3, right. And you have to find out also, v 1 v 3 and v 2 from the circuit you can easily wake out, v 1 is equal to 2 i 1, v 3 is equal to 4 i 3, and v 2 is equal to 8 i 2. Because everywhere current is entering into the your positive polarity of the resistance. So, sign is plus from the ohm's law. That we have discussed before, right. And 2 voltage sources are there, it is 5 volt plus minus and the 3 volt here also minus plus this way it has been marked.

Now, what you do you have to apply KCL and KVL, right? So, first you apply KCL at node a so, this is this is my this is my node a, this is this is my node a, right. So, I am not marking again that in by color your ink, but this is your node a from the circuit. So, apply KCL here if you apply KCL, incoming current at node a is i 1, right. And outgoing currents are i 2 and i 3. So, when you applying KCL at node a that i 1 is equal to i 2 plus i 3. So, i 1 is equal to i 2 plus i 3, this is equation 1

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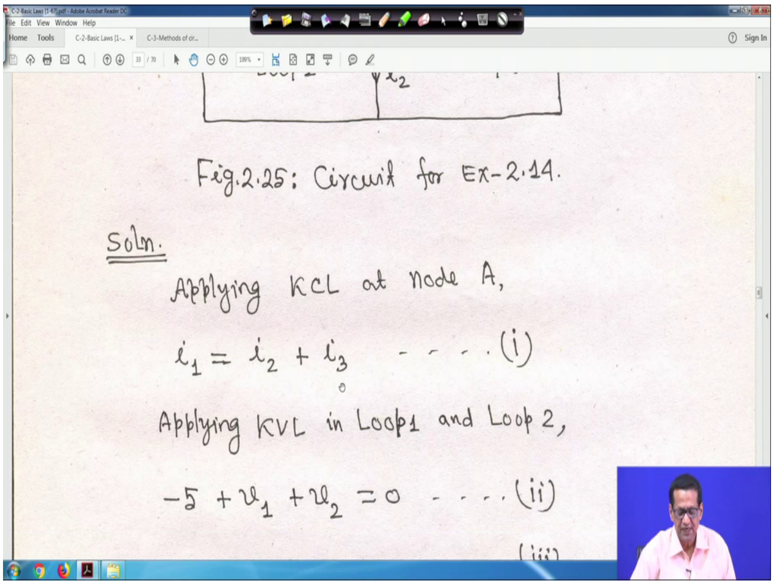


Now, you apply KVL in loop 1, if you apply KVL in loop 1. So, you are encountering first this minus terminal of the 5-volt dc source. So, it will be minus 5 plus, here it is then you are moving like this encountering plus terminal again. So, minus 5 here it is plus v 1, and here again also when I will moving clockwise encountering plus first. So, plus v 2 so, minus 5 plus v 1 plus v 2 is equal to 0. So, that means, this your applying KVL in loop 1 it is minus 5 plus v 1 plus v 2 is equal to 0 this is loop 1, now and in loop 2, now here it is in loop 2.

Now, if you come to loop 2, if you come to loop 2 you are moving you are clockwise direction you are moving. So, first I am taking this 1 minus v 2 this is minus v 2 then plus v 3, and then minus 3 is equal to 0, because this encountering minus terminal your minus polarity first, because moving clockwise then plus polarity first, then again minus polarity first; that means, minus v 2 plus v 3 minus 3 is equal to 0, that is in loop 2. So, it is minus v 2 plus v 3 minus 3 is equal to 0, this is equation 3, right?

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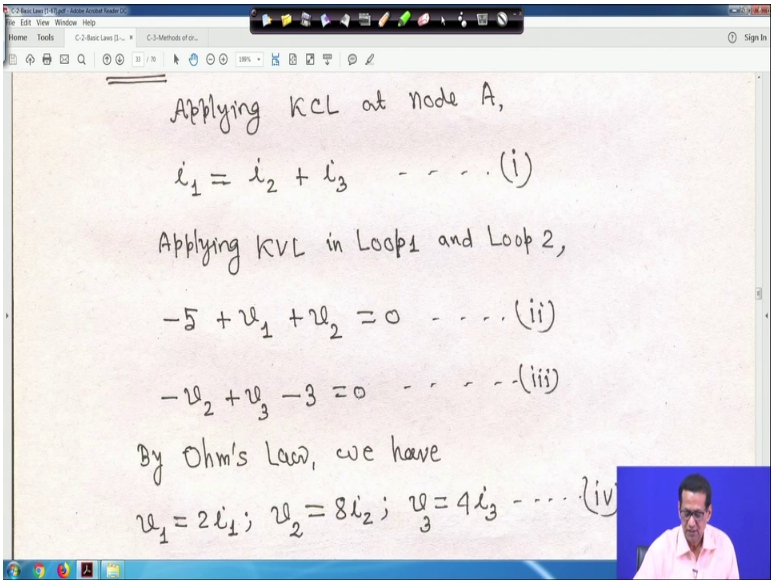


Now, by ohms' law by ohms' law, I told you at the beginning that v 1 will be from v 1 is equal to 2 i 1. Because everywhere you will see currents are entering to the positive polarity. So, v 1 is equal to 2 i 1, v 2 is equal to 8 i 2 and v 3 is equal to 4 i 3. So, those things I have write in together; that v 1 is equal to 2 i 1 v 2 is equal to 8 i 2 and v 3 is equal to 4 i 3. All this thing combination is equation say 4, right?

Now, substitute your v 1 is equal to 2 i 1 v 2 is equal to 8 i 2 in equation 2, and you will get if you substitute in equation 2; that means, these equation if you substitute in equation 2, right? You will get 2 i 1 plus 8 i 2 is equal to 5, this is equation 5. So, just you just little bit you simplify, right. So, every step you will write it will take you know it will take a consume lot of time, right. So, similarly you substitute v 2 is equal to 8 i 2, and v 3 is equal to 4 i 3 in equation 3; that means, this equation you substitute v 2 value and v 3 value, this equation 3 you substitute.

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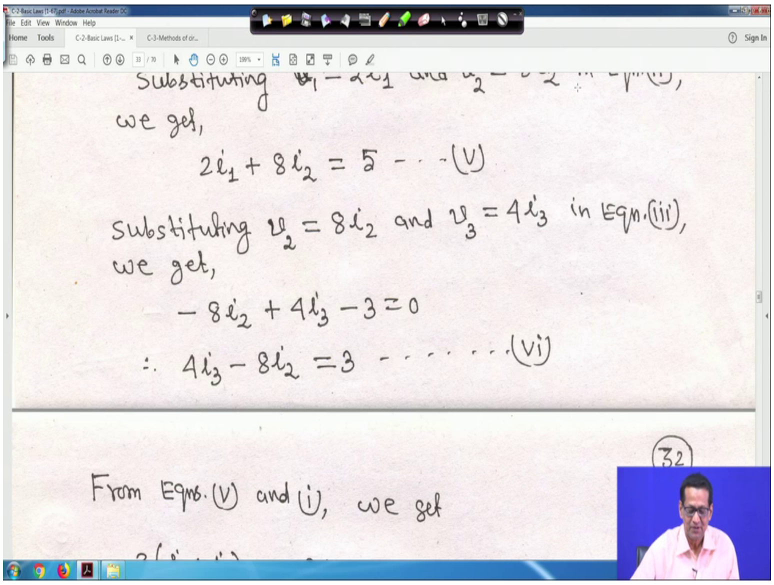


If you substitute you will get your minus 8 i 2 plus 4 i 3 minus 3 is equal to 0 or other way I have writing 4 i 3 minus 8 i 2 is equal to 3, this is equation your 6, right? So, you solve from equation 5 and 1 we will get. So, equation 5 and equation 1, equation 1 is equal actually equation 1 if you look at the equation 5, right. Equation 5 i 1 and in the equation 1 i 1 is equal to your i 2 plus i 3. So, from case here that is that is i 1 is equal to i 2 i 2 plus i 3, this is equation we will substitute there in this equation, right.

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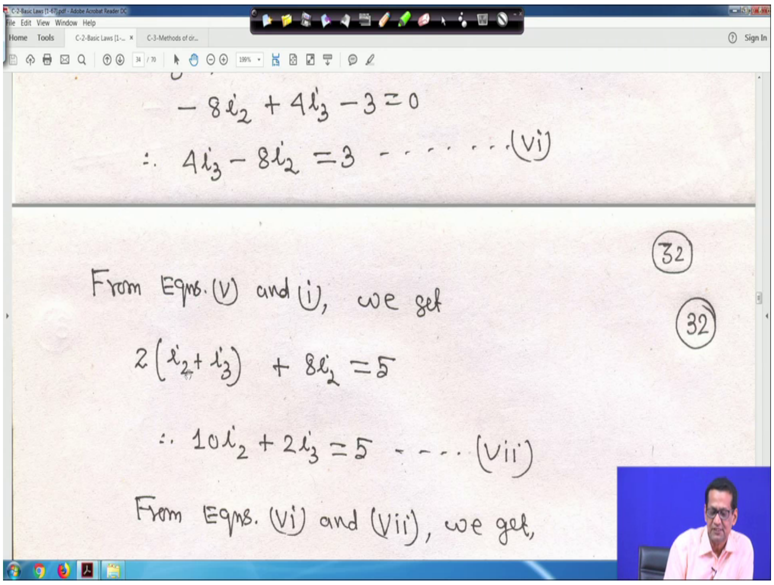

So, in equation 5 we substitute that i 1 is equal to i 2 plus i 3. So, 2 it was 2 i 1 plus 8 i 2 is equal to 5, but here you are putting i 1 is equal to i 2 plus i 3. So, 2 into i 2 plus i 3 plus 8 i 2 is equal to 5 or 10 i 2 plus, after simplification 10 i 2 because 2 i 2 plus 8 i 2 10 i 2 plus 2 i 3 is equal to 5 this is equation 7, right.

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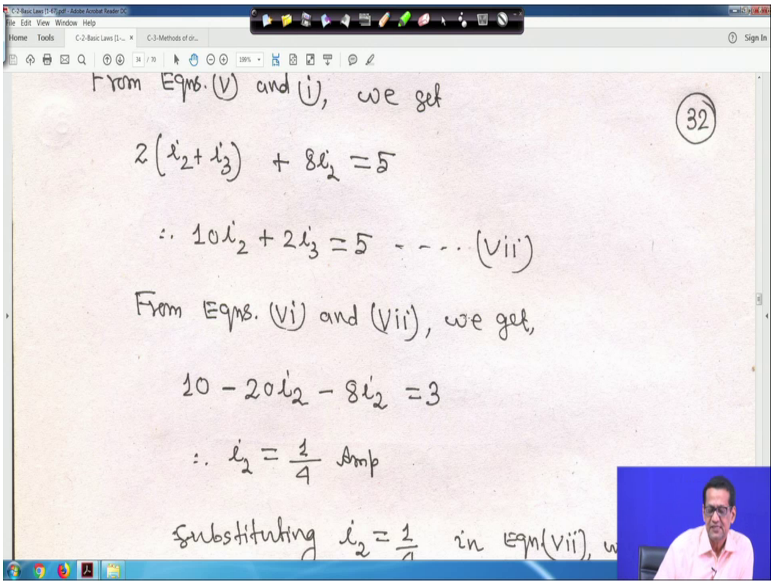


Similarly, from equation 6 and 7 you get the 10 that 6 and 7 just little bit you substitute and do it, 10 minus 20 i 2 minus 8 i 2 is equal to 3, right? So, if you go to the equation 6 this equation your this 4 i 3 minus 8 i 2 is equal to 3. So, just you put mathematical just substitution one after another.

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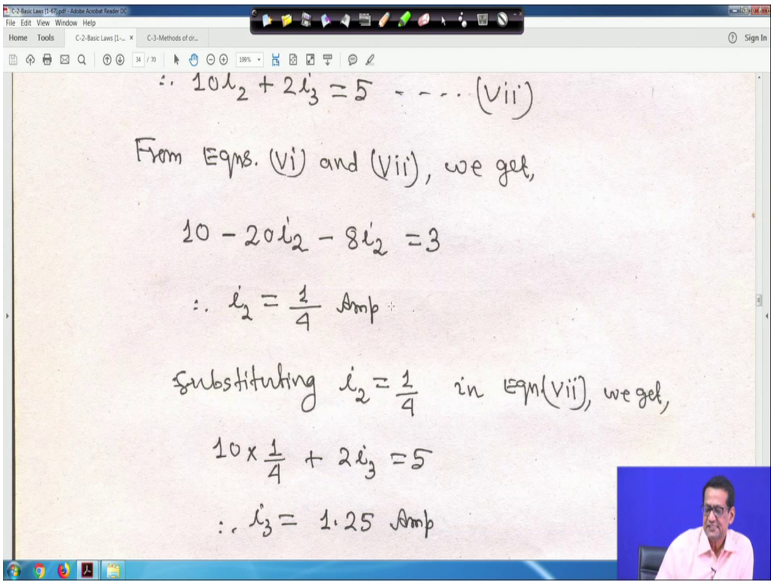


So, if you from equation 6 and 7, if you solve it will be 10 minus 20 i 2 minus 8 i 2 is equal to 3, upon solving i 2 is equal to 1 upon 4 ampere, right? And substituting i 2 is equal to 1 upon 4 in equation 7, you put i 2 is equal to 1 upon 4, you will get 10 into 1 upon 4 plus 2 i 3 is equal to 5.

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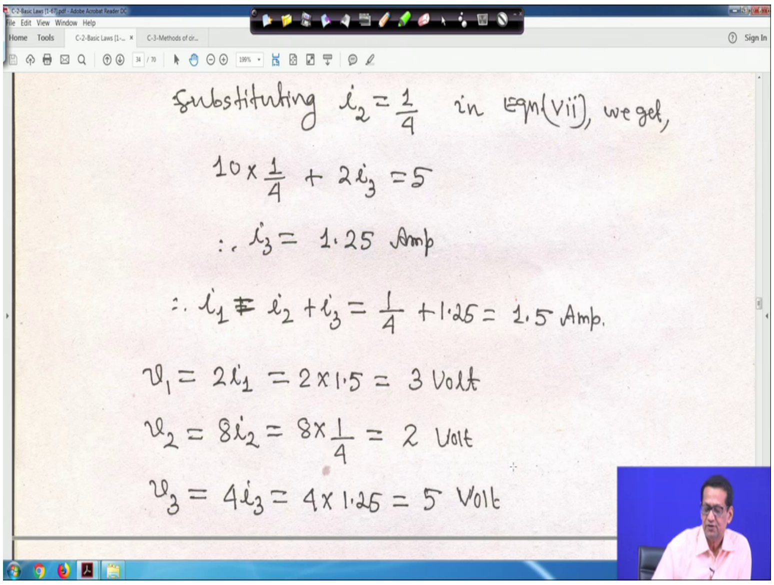


After solving i 3 is equal to 1.25 ampere. And we know from the equation 1 i 1 is equal to i 2 plus i 3. So, 1 upon 4 plus 1.25 that is equal to 1.5 ampere, right? Therefore, v 1 is equal to 2 i 1, that is 2 into 1.5 is equal to 3 volt, right. V 2 is equal to already we have seen 8 i 2 8 into 1 upon 4 2 volt, and v 3 is equal to 4 i 3. So, your 4 into 1.25 so, that is your 5 volt so, v 1 v 2 v 3 we got and similarly we got i 1, i 2 and i 3.

So, you know the you know now how to solve this one, right? So, these are the your what you call? These are the different techniques we later we will find out some more different techniques to find out this solution of this. So, dependant source independent source so, these are the things quite comfortable and will be easier for you, right. Next is that your series resistors and voltage division.

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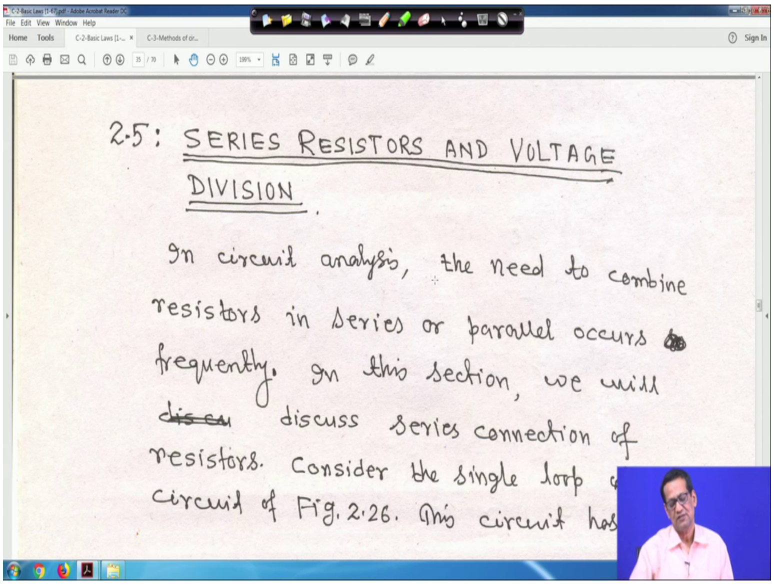


In the first we will consider the combination of series resistor, resistors and then we will see the parallel one, right? So, series resistors and your voltage division so, basically it is called series resistor and this kind of circuit we called as voltage divider, right. How will come later? So, in circuit analysis, actually it then actually we have to need to combine the resistor, either in series or parallel occurs frequently, right.

So, we have to simplify the circuit the that is why we have to go all these simple analysis. So, in this lecture we will discuss that series connection of the resistor. So now we consider this circuit, right you consider you consider this circuit, it is a simple circuit, right.

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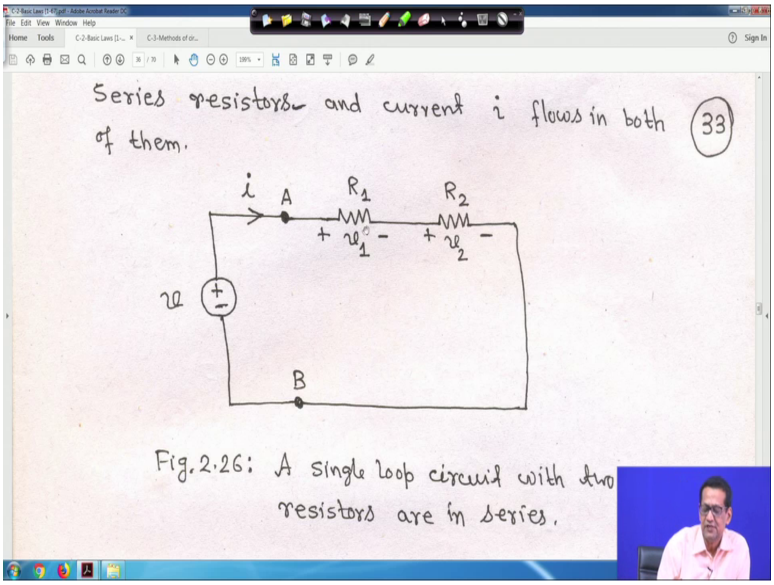


There are 2 resistor resistors R 1 and R 2; they are connected in series, right. Voltage across them it is v 1 and v 2, and their polarity are marked, right? And current through this circuit is i, and this is the terminal a and b these 2 terminals are given, and across this terminal it is connected in series and one voltage source is there v and polarity is marked plus and minus, right?

So, it is the single loop circuit with 2 resistors are in series, and one voltage source is there, right. So, in this case you also apply the same thing that KVL 1. So, by a first you if you first apply ohms law, from ohms law v 1 is equal to i into R 1 and v 2 is equal to i into R 2.

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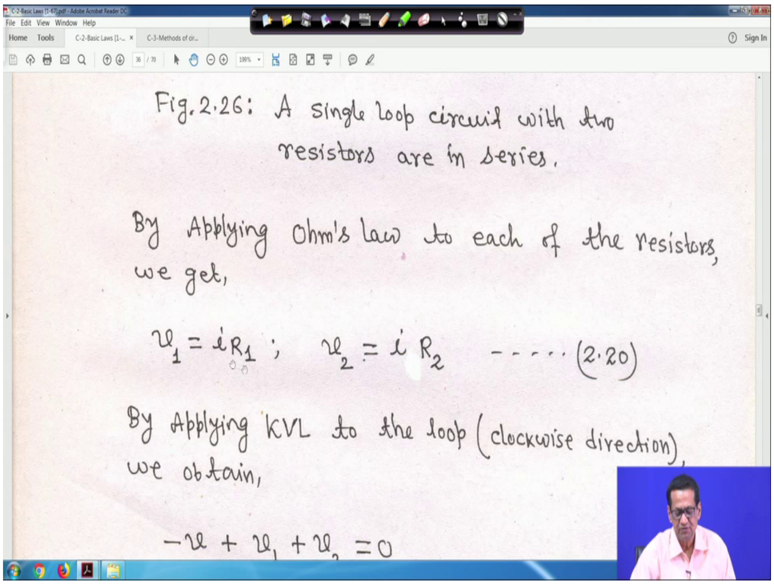


So, that means, your v 1 is equal to i into R 1 and v 2 is equal to i into R 2.

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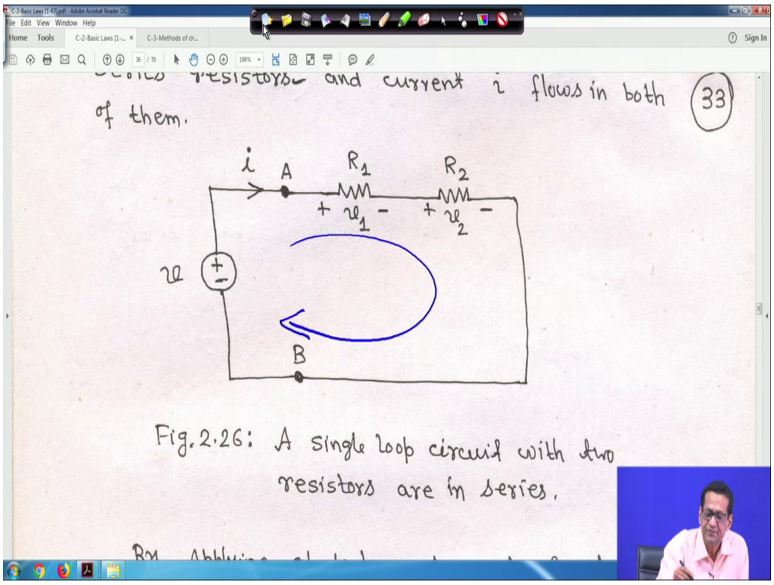


Now, you apply KVL, KVL you go for your what you call that your clockwise you go this is your you go clockwise, right? So, in this case it will encounter minus terminal first. So, it will be minus v, then you moving clockwise so, it will encounter plus terminal here, for R 1 and plus terminal here for R 2. So, minus v plus v 1 plus v 2 is equal to 0. So, let me let me clean it, right so, just hold on.

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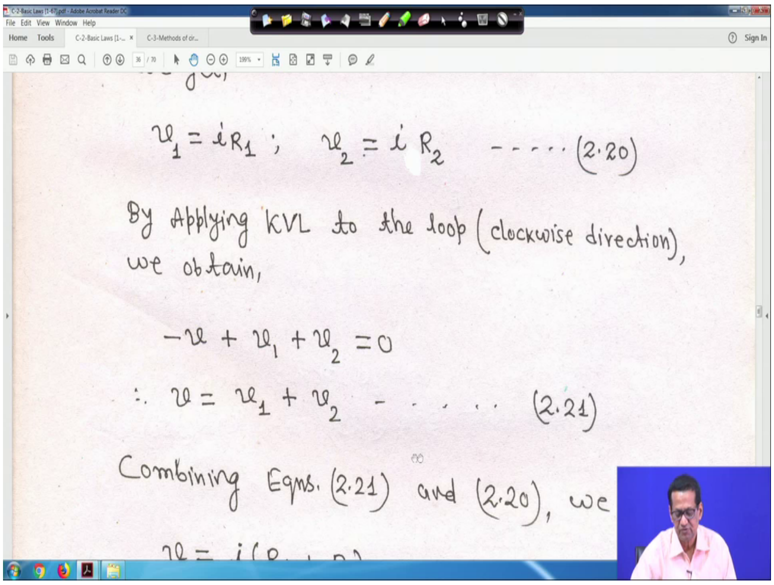


So, in this case your so, in this case it is minus v plus v 1 plus v 2 is equal or v is equal to v 1 plus v 2. So, v 1 is equal to your i your here it is v 1 is equal to here it is iR 1, right. And here it is your iR 2 in that is equation 20. So, here you substitute, then you will get v is equal to your v it is it is iR 1 plus iR 2. So, ultimately it is v is equal to i into R 1 plus R 2, that is equation say 22, right. The 2.22, because it is the chapter 2 that is why 2.22, but I will make 21 20 like the understandable to you, right. Therefore, i is equal to v upon R 1 plus R 2, right?

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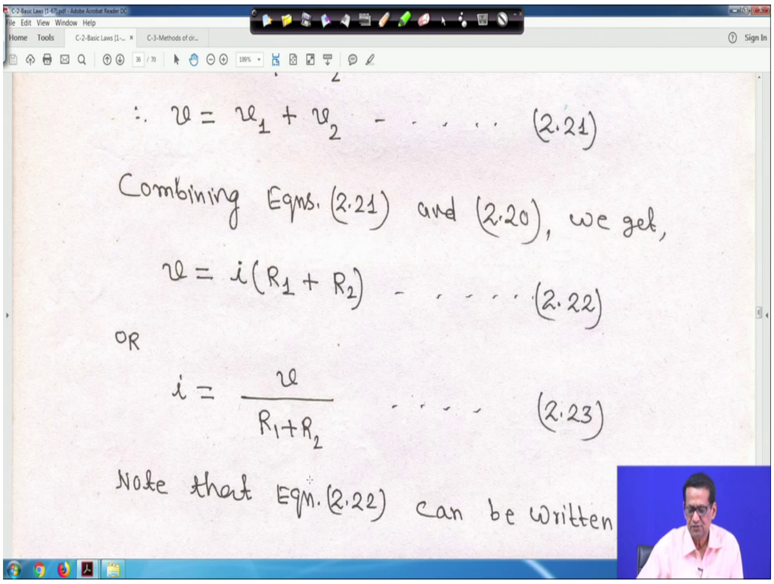

So, that means, equation 222, it can be written as that v is equal to i into R eq that is equivalent resistors. R eq is equal to your R 1 plus R 2, right. So, implying that the resistors can be replaced by an equivalent resistor R eq so, that is R eq is equal to your R 1 plus R 2, this is equation 25.

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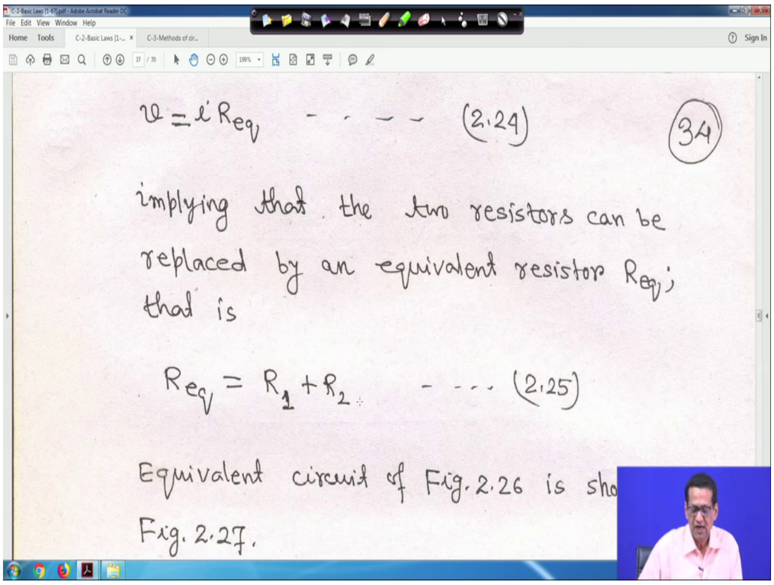


So, equivalent circuit of figure 2.22 that is your figure 26, this the for this it is equivalent circuit will be now this one, right. So, this is your equivalent circuit; that means, your voltage source will be there as it is, and R eq is nothing but your R 1 plus R 2, and voltage across this is also v, because we have seen that v 1 plus v 2 is equal to v. Because here it is your v 1 plus v 2 from equation 21 v 1 plus v 2 is equal to actually v, right? That is that is that your source voltage.

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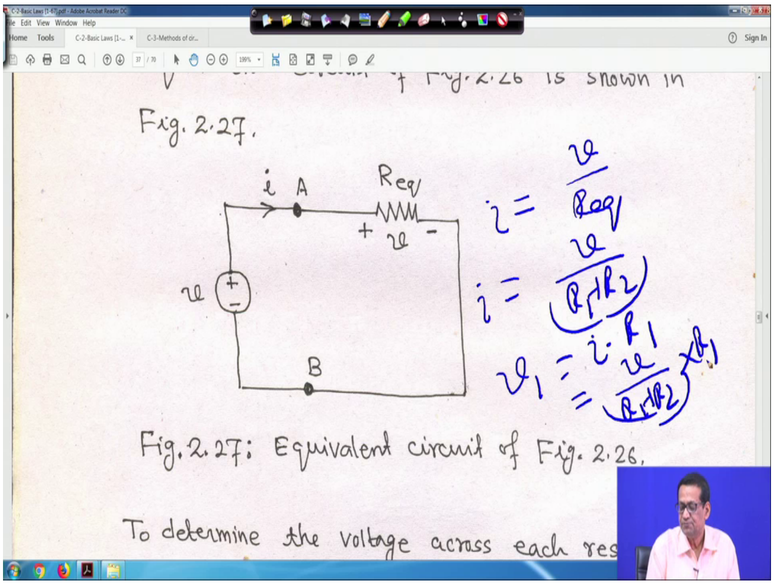


So, that is why here also it is written, that your v 1 plus that is v is equal to v 1 plus v 2 that is total voltage. So, it is v and current flowing through this is i, right. So, this is the equivalent circuit.

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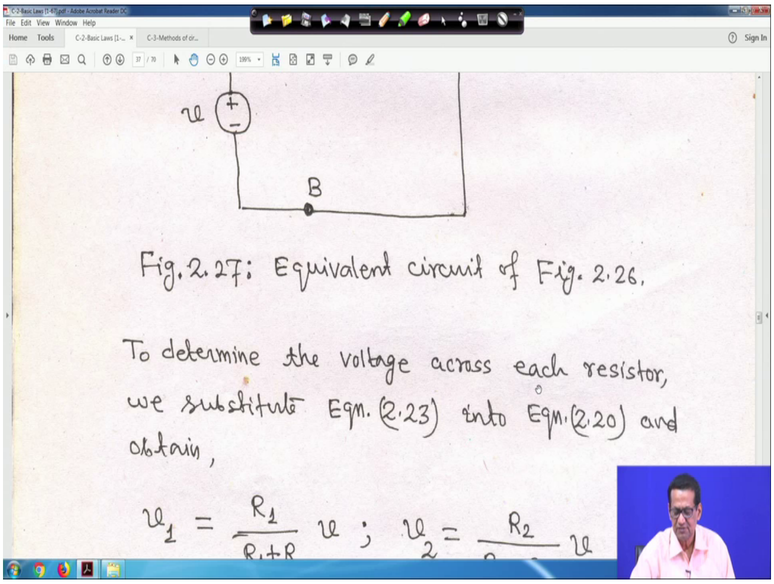


Now, to determine the voltage across each resistor, let us we substitute equation 23 into equation 20 and we will get.

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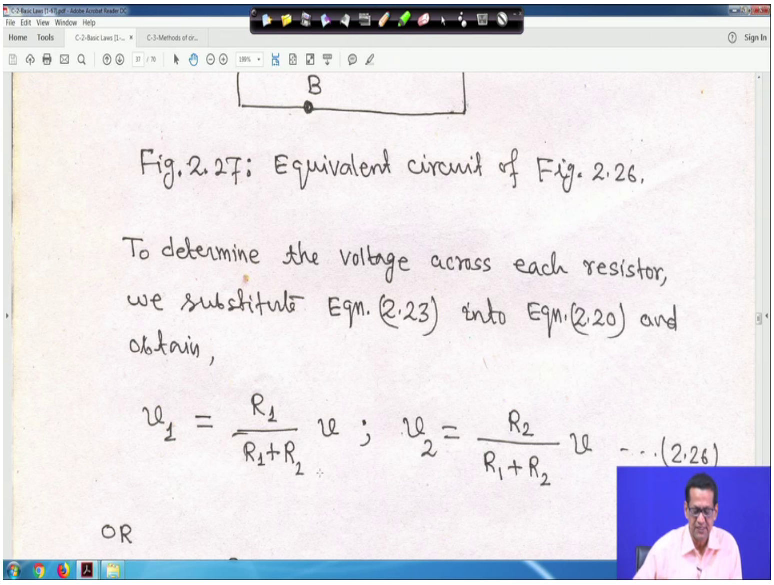


So, v 1 is equal to then will become R 1 divided by your R 1 plus R 2. It is very simple just hold on, it is very simple, that your v 1 is equal to R 1 into i, right. And from this and from this from this your what is just hold on, just hold on, let me clean it.

Here, here from here just hold on, from here your i is equal to your v upon Req, right; that means, your i is equal to R eq is equal to your R 1 plus R 2, right. That is your R eq is equal to your R 1 plus R 2, and if you go to that your what you call that v 1 is equal to your i into R 1, right. Because from the first circuit we have seen; that means, your this one is equal to actually v divided by R 1 plus R 2 into your R 1 that is your v 1, if you first let me clean it then I will go, right?

So, if you come to this circuit come to this circuit v 1 is equal to i into R 1 and i is equal to v upon R 1 plus R 2. So, basically it is R 1 into v upon R 1 plus R 2. So, that what we are doing here, right; So, what we are your doing here, that v 1 is equal to R 1 by R 1 plus R 2 into v, right. Similarly, v v 2 is equal to your i into R 2, and just now we have seen i is equal to v upon R 1 plus R 2. So, v 2 is equal to R 2 into v upon R 1 plus R 2 these 2 are equation 26. So, this is actually your what you call if you or or we can write that R 1 plus R 2 is equal to actually R eq because earlier that is R Req.

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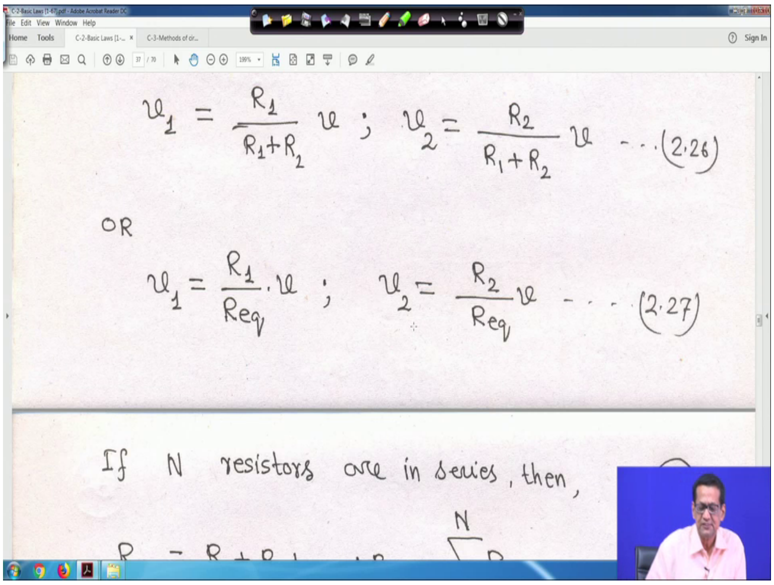


So, this equation v 1 we can write R 1 upon R eq equal to v and v 2 is equal to R 2 upon R eq into v. So, these 2 2 equations we are writing as a complete equation so, this is 27, right. Now you have if your N resistors are in series, if your N resistors are in series then R eq will be R 1 plus R 2 plus RN.

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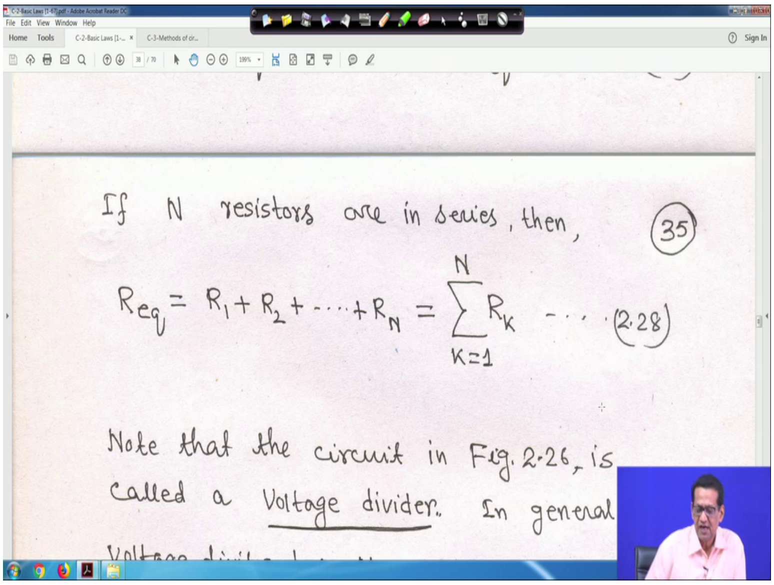


So, sigma k is equal to 1 to N into R 1 into N Rk, right. So, if we have a N number of your resistors are in series, right?

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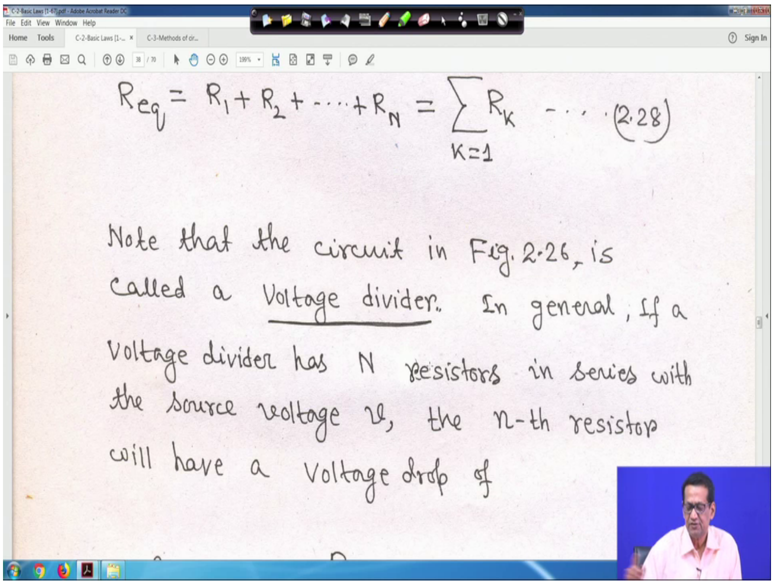


So, therefore, the therefore, this the circuit of 226 is called a voltage divider, right. Because across R 1 we will get v 1, across R 2 we will get v 2, and and so on and across Rn the nth resistor, you will get vn. So, v should be is equal to v 1 plus v 2 plus dot, dot, dot, dot, dot, plus vn, right that you will get it. So, that is why it is called your voltage divider. In general, if a divider has a N resistors in series with the source voltage v the nth resistor will have a voltage drop of this thing, right?

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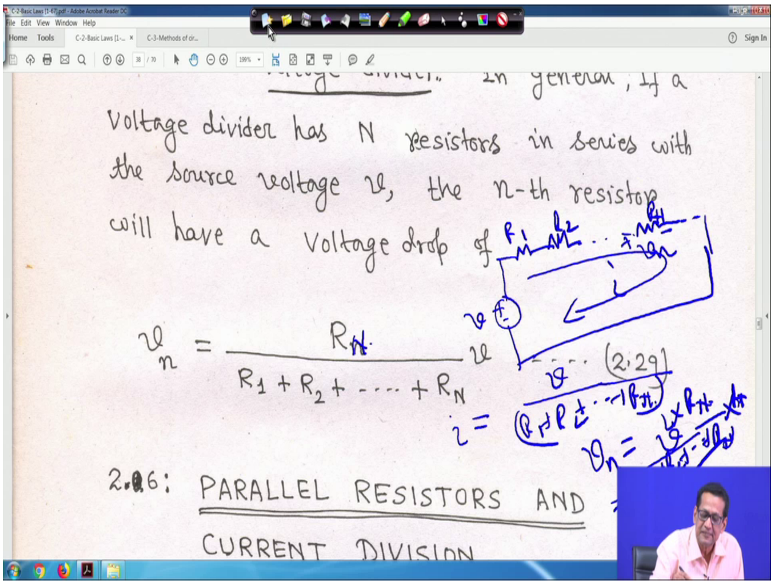

Again if you have a vn, then suppose your your nth resistor is Rn, right. And if you have a n number of resistor Rn. So, it will be your vn should be is equal to Rn upon R 1 plus R 2 plus Rn at the your up to RN into v. Because the current actually i for a if you have n just a just a minute for you i will make it I will make it for you, right. Suppose you have a circuit like this. Suppose I will making it for here I will making it for suppose this is your voltage source. Say, this is your v suppose we have a resistance R 1, you have a resistance R 2, and suppose you have a resistance your Rn, right. This is your R 1, this is your R 2 and up to say this is your RN, right and circuit is close.

And suppose current is flowing through this is i, right? So, your R eq that is your i is equal to, right in here say i is equal to it should be v upon your R 1, whatever equation here I will writing R 2, right plus up to RN, right. Up to Rn so, this is i so, across the across your what you call voltage across this your R this is Rnth your nth your element, right or nth resistor suppose this is your Rn, right.

So, this is actually here it is you have a N resistor and Nth resistor. So, here what I can do is, that you have taken Nth capital. So, better you make it to capital that will be better, right make it Rn capital. So, this is Rn capital, suppose this is your plus terminal this is minus terminal, right. Therefore, your and voltage across this voltage across this hopefully it is understand understandable to you say vn.

So, vn is equal to your i into your Rn, right. And R Rn and i is equal to your i is equal to writing here i is equal to your this one just we got know v upon R 1 plus R 2 plus up to Rn, right; this one into your capital Rn. That whatever sorry into v sorry Rn by this thing v upon R 1 and into capital R 1 so, here Rn I have written first. So, it is v upon this thing so, these equation you further, right. That your, what you call that vn is equal to this RN RN is I have writing here RN. So, I am making RN upon R 1 plus R 2 up to RN into v so, this one. So, hopefully I mean here little bit becoming clumsy, but hopefully it is understandable to you so, let me clean it, right so, this is for series series resistor.

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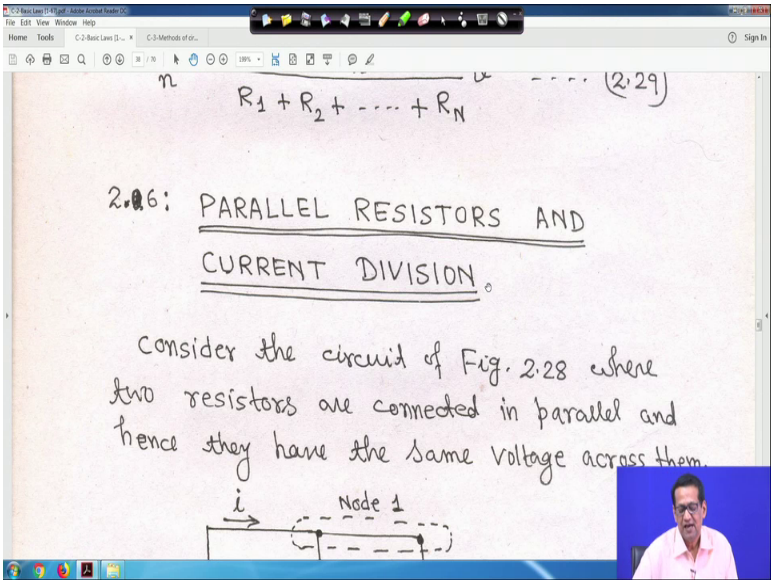


Now, we come to the parallel resistor, and the current division, that was series resistor and voltage division, and for in parallel resistor, it will be parallel resistors and current division, right.

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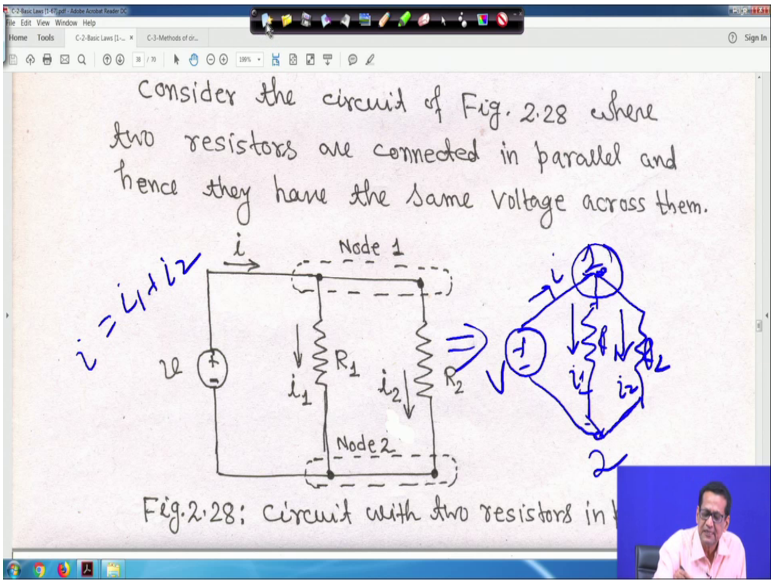


Now, consider this circuit of figure your 28, right; where 2 resistors are connected in parallel, and hence they have the same voltage across them. So, this is a simple circuit because this is raw air. So, these two are combined, because it will be a single node because nothing is there in between these 2 points. Similarly, here also nothing is there in between these 2 point, here also nothing is there. So, if I if I further simplify for you, right. If I make it like this circuit, because here nothing is there it is it is an wire, it is a wire and it is a wire. So, if you if you make like this circuit will be like this, it is be it will be a single node, right. It will be like this, this is a R 1, right. Also it is it is your R 2 connected like this and nothing is there, and this is your voltage source v, the circuit will look like this, right. This is your node 1 and this is your node 2, right?

And current flowing through this is i 1; that means, current through this is your i 1 and current through this is your i 2, and this is the current that is your i that is whatever this circuit is equivalent to this one, right because it is a all or this is actually common point; that means, your i is equal to basically i 1 plus i 2. If you write KCL at this node and; that means, this point, this is node 1 together because it is a wire.

So, at this node if you write so, this incoming current at node 1 i and 2 outgoing current i 1 plus i 2; that means, your i is equal to your i 1 plus i 2, right? So, things are understandable simple thing understandable, right? So, let me clean it. So now, for ohms' law, you will get same thing that v your what you call? V is equal to your i your this is a parallel circuit. So, voltage across this, just now I showed this, that voltage across this, it will be your v is equal to because same voltage will be impressed across this just now I draw the equivalent circuit.

So, v will be is equal to i 1 R 1, similarly is equal to i 2 R 2, because there is no resistor, no, other your electrical element is here and here. So, this voltage v will be impressed across this 2 node, right. So, it is a parallel circuit so, v will be is equal to i 1 R 1 is equal to v will be also is equal to your i 2 R 2, right? Understandable, I mean there should not be any confusion ok, for you let me make it once again, suppose this is same thing I am drawing.

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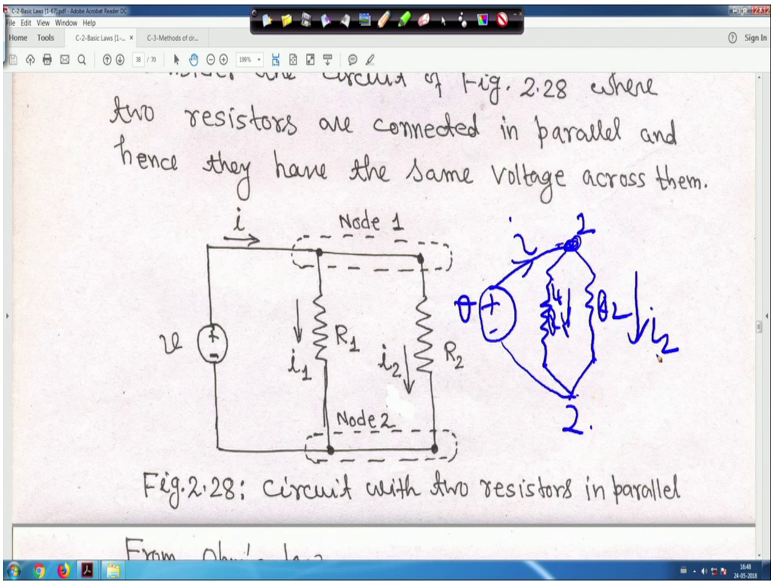


Suppose this is your resistance another one, and this is one, this is your node 1, just now we draw this is node 2, and this is the voltage source, right. I will making it here this is the voltage source plus minus, right and connected here.

This is your R 1, this is your R 2 current through R 2 is i 2 current through R 1 is here i 1 and this is your i and this voltage is v. So, voltage across one and 2 is v actually. So, v will be is equal to i 1 R 1, and similarly v will be your across R 2 will be this is R 2 into i 2. So, let me clean it, right.

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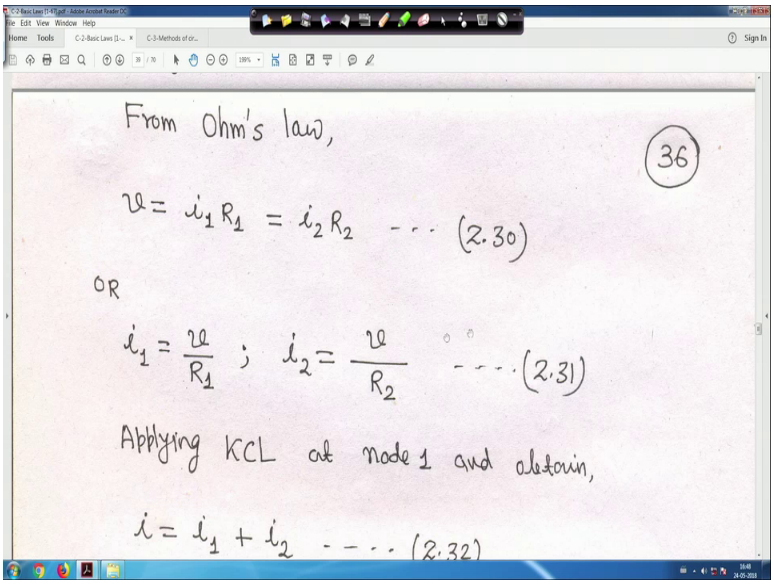

So, that means, from ohms' law so, v is equal to i 1 R 1 is equal to i 2 R 2 we can write, now I therefore, from this equation, we can write i 1 is equal to v upon R 1, and here also we can write i 2 is equal to v upon v upon R 2, right? So, and apply KCL at node 1, I have told you that if we apply at node 1 i is equal to i 1 plus i 2. So, it will it will be your what you call i 1 plus i 2. Now i 1 is equal to v upon R 1 i 2 is equal to v upon R 2.

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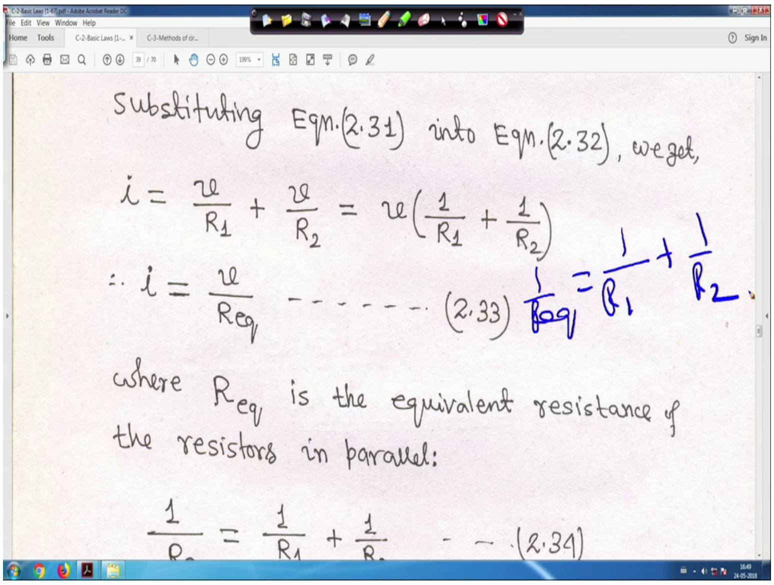


So, you substitute here i 1 plus i 2 so, I will be v upon R 1 plus v upon R 2 is equal to v 1 upon R 1 plus 1 upon R 2, right. Where i is equal to we can write v upon R eq, right; that means, what we did that this one this one. So, we are writing v upon R eq; that means, what we are doing is we are actually writing 1 upon R eq is equal to 1 upon R 1 plus 1 upon R 2, right

So, because i is equal to you have to make v upon R eq that is a current i. So, 1 upon R eq actually a 1 upon R 1 plus 1 upon R 2, that what that what we are actually you are writing, right; so, that means, that it is the equivalent it is the equivalent resistance.

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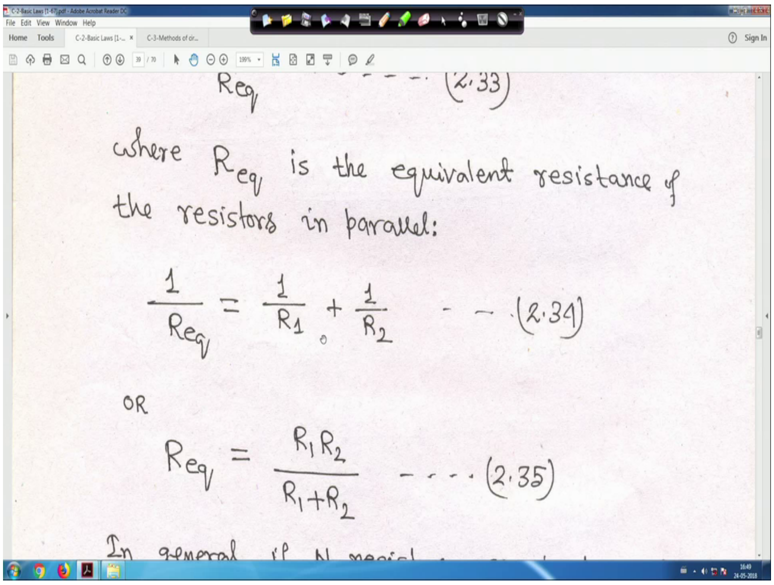


So, 1 upon R eq we have 1 upon R 1 plus 1 upon R 2 so, R eq actually is the equivalent resistance. So, otherwise R eq is equal to R 1 R 2 upon R 1 plus R 2. Then product of 2 resistance divided by the sum of the 2 resistance, right? So, R eq is equal to R 1 R 2 upon R 1 plus R 2 this is equation 35, right.

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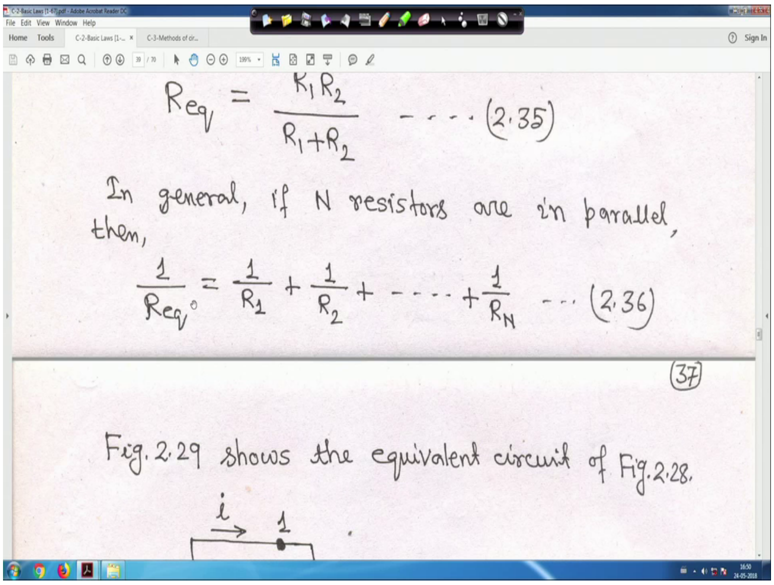


So, in general if your N resistors are in parallel, then 1 upon R eq is equal to 1 upon R 1 plus 1 upon R 2 up to 1 plus 1 upon Rn, right. So, you take summation of reciprocal of that, and then you you then you take the your what you call that further your in a your inverse of that, right. So, 1 upon R eq is equal to 1 upon R 1 plus 1 upon R 2 up plus 1 upon Rn. So, that R eq is the equivalent resistance.

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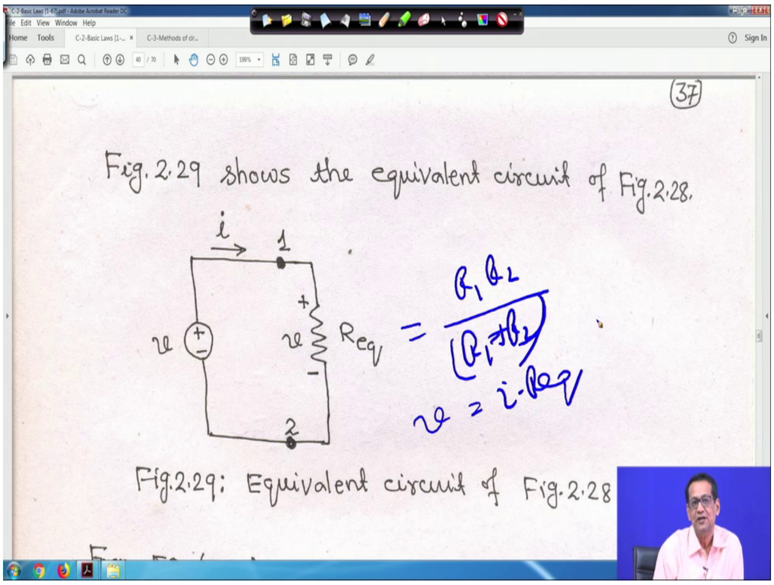


So, figure 2.29 shows the equivalent circuit, this is your R eq; R eq means, this is the equivalent circuit, right this basically just hold on, basically this is your R eq is equal to R 1 R 2 by R whatever we have written R 1 plus R 2, right. So, and at this is their node 1 this is node 2. So, across R eq voltage impressed is your v, same voltage v will be impressed. So, v is equal to actually i into R eq, right? So, if you write v, v is equal to is equal to i into R eq, right so, things are understandable, right so, just hold on.

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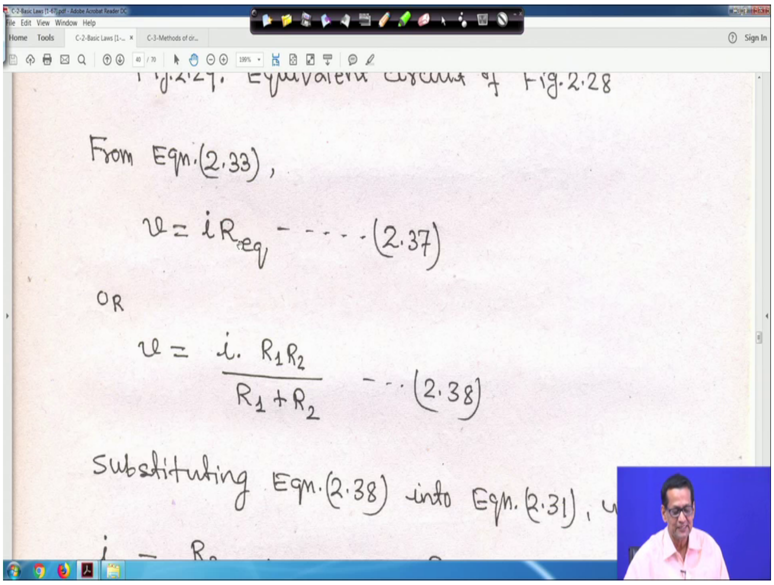


So, that is what I told v is equal to i into Req. Now R eq is equal to you know that is I R eq is equal to R 1 R 2 upon R 1 plus R 2. We substitute R eq is equal to here is that is equation 38.

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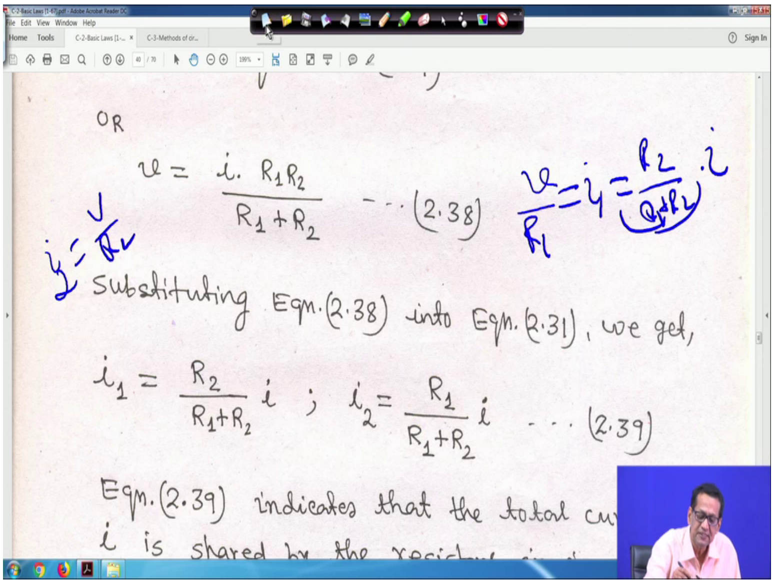


Now, substitute equation 48 into equation your 31, that you will get. So, you will get i 1 is equal to your what you call R 2 upon your R 1 plus R 2 into i. Because you know this one if you go to equation 31, you go to equation 31, that is your this equation, right. That is, i 1 is equal to v upon R 1 and i 2 is equal to v upon R 2, right?

So, when you are coming there, that i 1 is equal to your v upon here, i 1 is equal to v upon your what you call v upon R 1, right. So, and your; that means, v upon R 1, if you take this one you will get i into R 2 upon R 1 plus R 2; that means, your if you just hold on from this equation only you will get v is equal to i into R 1 plus R 2 upon R 1 plus R 2. So, from this equation we will get know that is v upon your R 1, right? That is nothing but your i 1, right from this equation if you write it is basically look R 2 upon R 1 plus R 2 into your i.

Same thing is coming here i 1 is equal to R 2 upon R 1 plus R 2 into I from this equation, only just divide this equation by R 1. So, v upon R 1 is equal to R 2 upon R 1 plus R 2 into i. Similarly, the for i 2 is equal to, for i 2 is equal to your v your v upon R 2 i 2 is equal to v upon R 2. So, this equation you divided by R 2 so, basically your i 2 is equal to v upon R 2. So, divide this equation by R 2, you will get R 1 upon R 1 plus R 2 imply you will get R 1 upon R 1 plus R 2 into i so, right. So, directly you are getting that i 1 and i 2.

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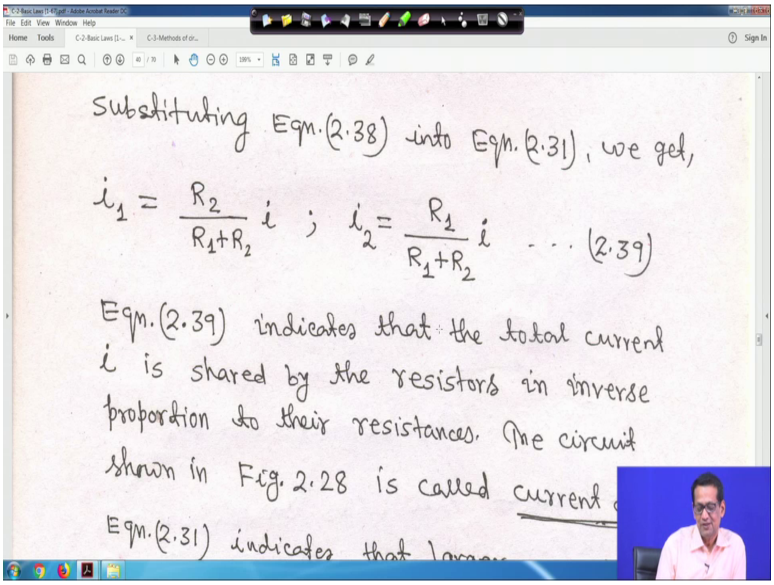


So, current division now, if you look into that just hold on let me clean it. So, just if you see that that equation 39, that is i 1 is equal to R 2 upon R 1 plus R 2 i i 2 is equal to R 1 upon R 1 plus that indicates that a total current i is shared by the resistor in the inverse proportion to the resistances, right. So, circuit shown in figure 28 is called the current divider.

So, if you go to equation sorry circuit figure 28, this circuit actually is called as current divider, right. So, right so, it indicates that to equation 31; indicate that the larger current flow through the smaller resistance is a understandable to you, right?

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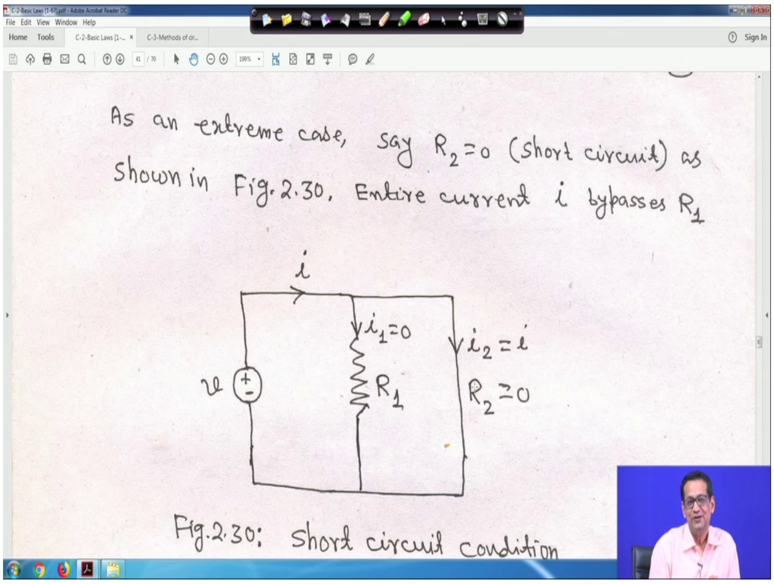


So, as extreme case say R 2 is equal to 0 short circuit as shown in figure 30 entire current I bypass R 1, if it is a short circuit, then R 2 is equal to your basically 0 right; that means, equivalent resistance say R eq is equal to R 1 into R 2 by R 1 plus R 2 so, R eq will become 0. So, it is a pure short circuit, if you make either of this either this one R 2 is equal to 0 or R 1 is either of this you make short circuit, and both 0 also short circuit, right. So, it is a pure short circuit.

So, thank you very much, we will be back again.