Circuit Theory

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Lecture - 50
Problem Session 11: Two-Port Synthesis

Today is the problem session 11 perhaps the last of day it is the last problem session and this problem shall be on 2-port synthesis. The first problem we do is 12.2. 12.2 gives 2 networks and says, so that the residue condition holds for the network shown in the figure.

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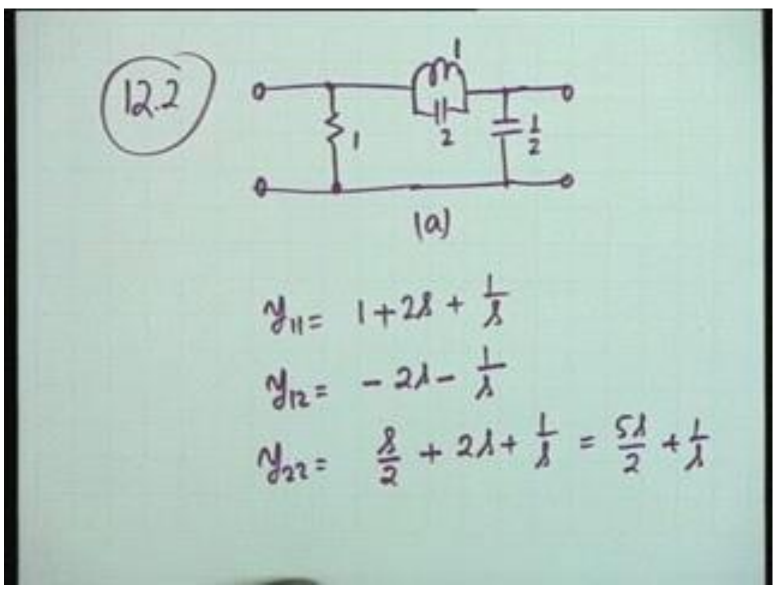

The first figure is 1 ohm then you have a 1 and 2 Farad and half Farad capacitor. It says simply that so that the residue condition is valid. Now, residue condition can be with regard to either Z parameters or y parameters. An obviously, if 1 is clever 1 should not try to find out Z parameters of this net and should only try to find out Y parameters and Y parameters are obvious. So, y11 is 1 plus the whole thing comes in parallel. So, s no 2s plus 1 over s agreed if this is shorted 2s 1 over s. y12 is equal to minus 2 minus 1 over s. And y22 is equal to s by 2 plus 2s plus 1 over s which is equal to 5s by 2 2 and a half 5s by 2 plus 1 over s.

Student: ((Refer Time: 02:12))

That is right if this is shorted these 2 capacitors come in parallel. So, s by 2 and 2s and I have combined them into 5s by 2. Now, the pole at infinity there are 2 poles 1 is at infinity and the other is at the origin.

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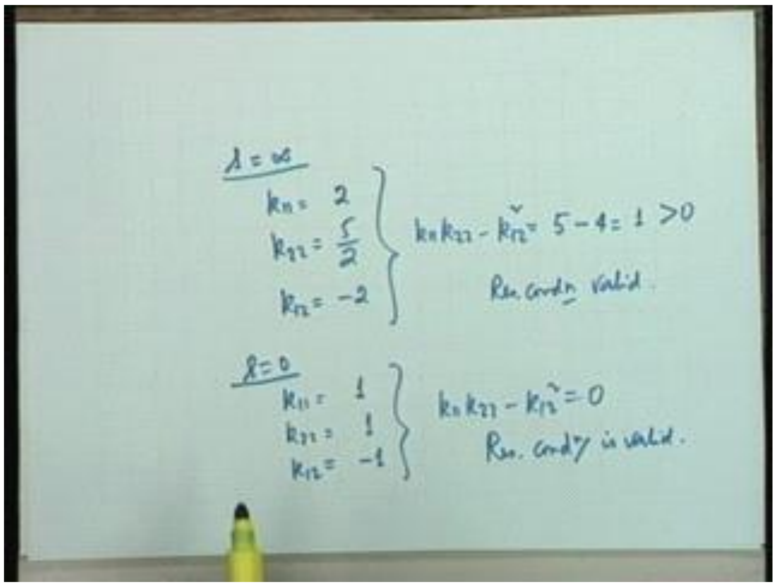

For the pole at infinity s equal to infinity k11 is 2 k22 is 5 by 2 agreed and k12 is minus 2. And therefore, k11 k22 minus k12 squared is equal to 5 minus 4 which is equal to 1 that is greater than 0. So, the residue condition is indeed valid for the pole at the origin k11 is 1 k22 is 1 and k12 is also is equal to minus 1. Therefore, k11 k22 minus k12 squared is equal to 0 again residue condition is valid. The b part any question on this.

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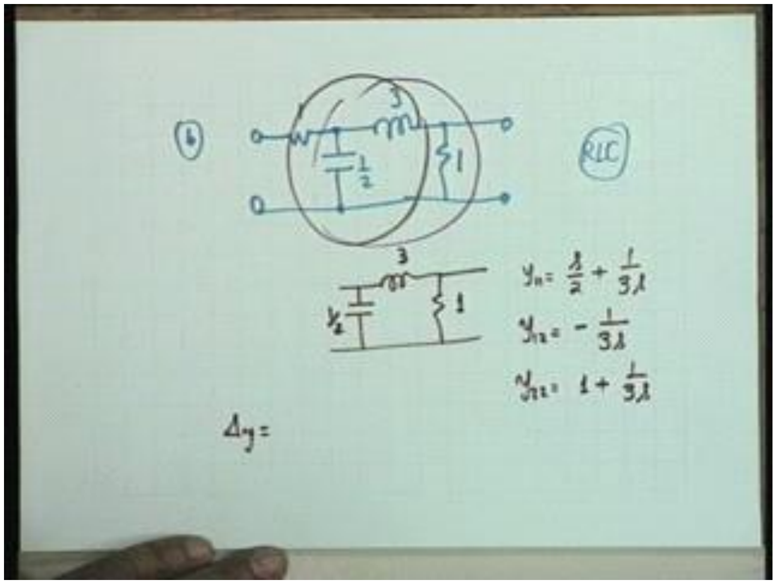

The b part is slightly unusual 1 has to think a little about it the network is this and you see that this is not a pure LC or RL or RC. Residue condition validity as I said happens only in 2 element kind networks it is not necessarily valid in 3 element kind network. This is an RLC network, but still the question says show that the residue condition is valid therefore, you shall have to find the poles of the 3 parameters the residue is there and show that the residue condition is valid is the point clear.

This is not an RC RL or LC network this is an RLC and it says that the residue conditions are valid you have to show them.

So...

Student: ((Refer Time: 04:58))

Yes, that is correct previous 1 was also RLC, but fortunately the poles where only on the j omega axis s equal to infinity and s equal to 0. May satisfy may not also satisfy. But let me let me mention to you just mention it is not very important at this stage. That in an RLC network if there are poles on the j omega axis then residue conditions must be satisfied. Poles on the j omega axis residue conditions have to be satisfied. This is not true for or any other kind of pole.

Now, for this part of the network which parameters would you like to find out z or y.

(Student: ((Refer Time: 05:57))

Y God see.

Either of them either them is good enough, but how. We can convert this 5 into a T and then add 1 ohm to z11 all right or we could convert we could convert this into a 5 and find Y parameters either of these 2 procedures will be. Do not try to find from the definition that is finding z11 z22 and. So, on this will be messy. Particularly in finding z12 you shall have write to node equations of low pass there is no other way.

Suppose, we take the first alternative that is you first find out the Z parameters of this network. I prefer not to memorize any formula except the conversion of parameter and that is very simply. So, for this network y11 is s by 2 plus 1 over 3s all right is that y12 is minus 1 over 3s and y22 is equal to 1 plus 1 over 3s. Therefore, del y the determinant y is a product of these 2s by 2 plus 1 over 3s multiplied by 1 plus 1 over 3s minus 1 by 9s squared. And if you simplify this I have done. So, I will skip some of the algebra.

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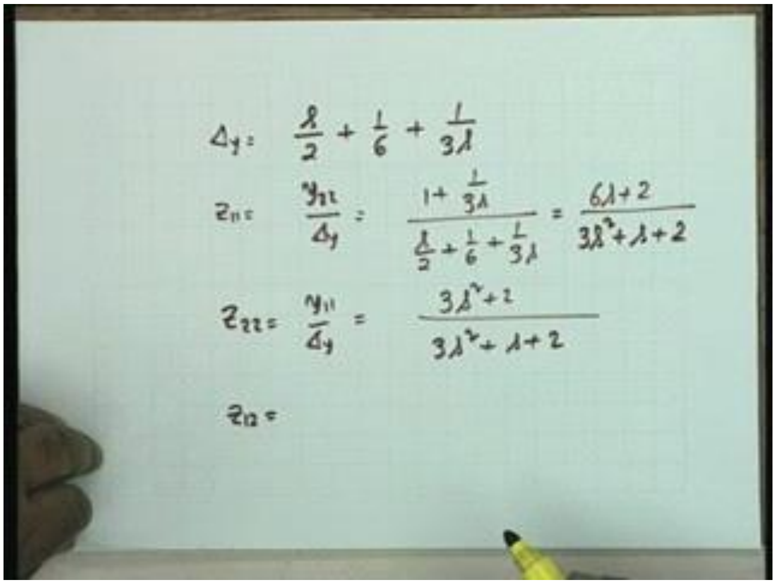

If you simplify this del y is equal to s by 2 plus 1 sixth plus 1 over 3s this is my result. Therefore, I find z11 as equal to you must remember this y22; that means, y22 by del y. So, it is equal to 1 plus 1 over 3 s divided by s by 2 plus 1 sixth plus 1 over 3s. And this simplifies to 6s plus 2 divided by 3s squared plus s plus 2. I hope I am right it is my calculation. In a similar manner you can find out z22 as y11 by del y this is not a symmetrical network unfortunately see we will have to find all of them. This comes out as 3s squared plus 2 divided by 3s squared plus s plus 2. Then z12 is.

Student: (Student: ((Refer Time: 08:58))

It is not visible.

Student: (Student: ((Refer Time: 09:05))

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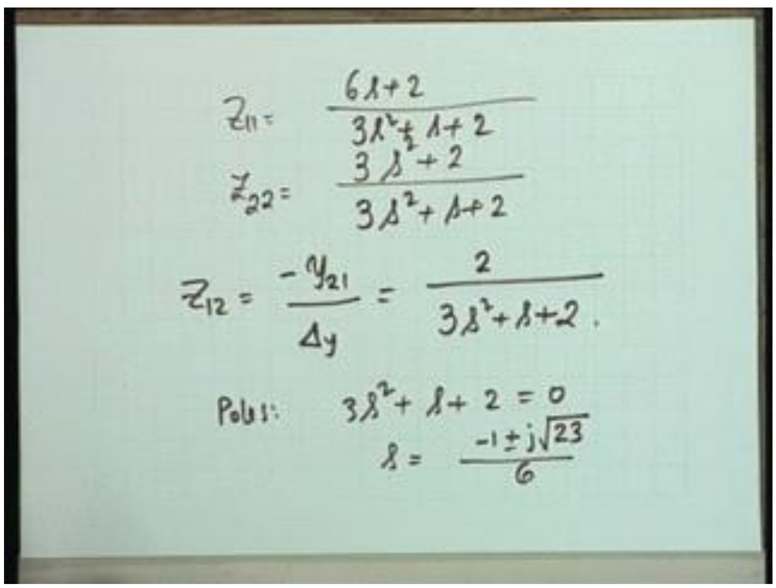

Let me write z22 is equal to 3s squared plus 2 divided by 3s squared plus s plus 2. Z11 is minus y21 by del y and this my calculation gives 2 divided by 3s squared plus s plus 2. Let me also write the expression for z11 this is 6s plus 2 divided by 3s square plus s plus 2. You notice that the 3 parameters have the same poles where are this poles. Poles are at 3s squared plus s plus 2 equal to 0. And if you solve this quadratic my solution is that poles are at s equal to minus 1 plus minus j square root 23 divided by 6. Not a happy situation, but not too bad either. There are 2 poles 2 complex conjugate poles you will have to find the residues at both the poles.

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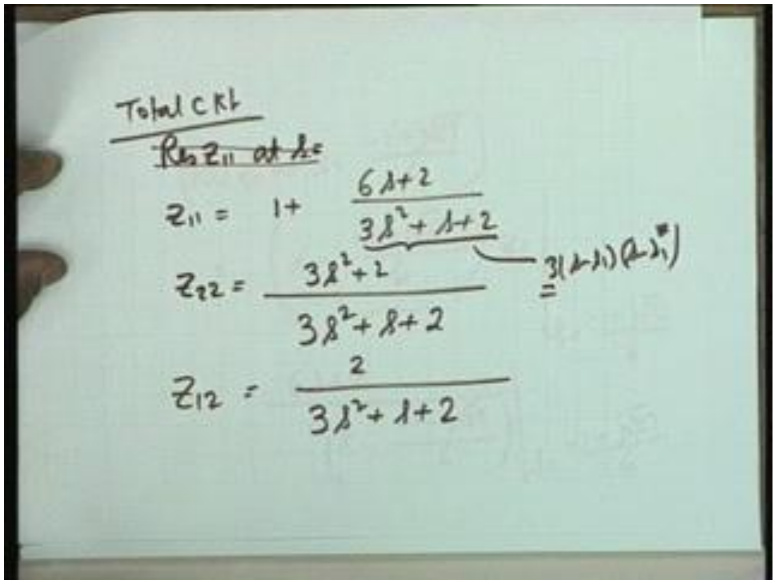

Let us find the residue of z11 let us say. Residue of z11 at s equal to.

Student: ((Refer Time: 10:33))

So, for the total circuit total circuit z11 equal to 1 plus 6s plus 2 divided by 3s square plus s plus 2 all right Z 2 2 remains the same. That is 3s square plus 2 divided by 3s squared plus s plus 2. And z12 is equal 2 divided by 3s squared plus s plus 2. Now, this addition of 1 does it change the poles. No. Does it change the residue? How do you know it does not change the residue? Why not let me tell you why not.

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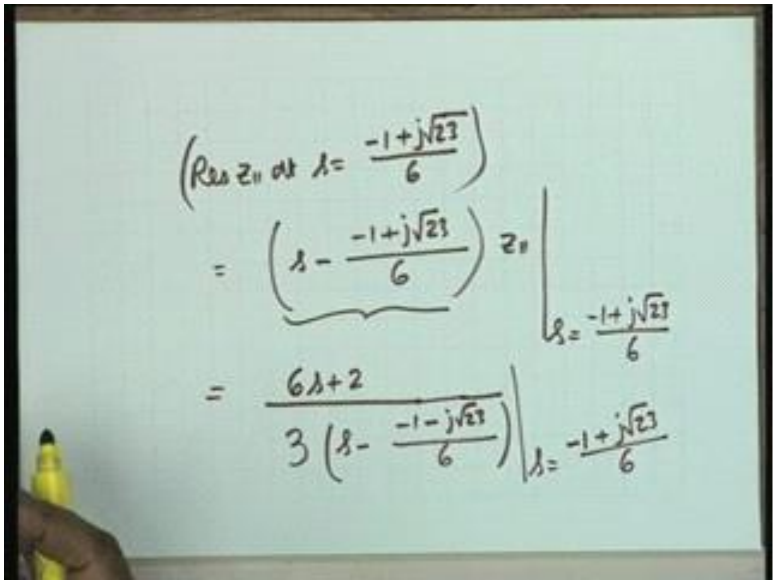

Residue of z11 at s equal to minus 1 plus j root 23 divided by 6. This should be this should be s then minus 6 minus 1 plus j root 23 multiplied by z11 at s equal to minus 1 plus j root 23 divided by 6. When this factor multiplies this constant 1 and you put s equal to this; obviously, that leads to 0. So, it does not change the residue is the point clear.

So, all we have to do is 6s plus 2 divided by what shall we be left herewith? If we multiply by this factor; obviously, the other factor

Student: ((Refer Time: 12:34))

S minus 1 minus j root 23 divided by 6 this is what shall remain.

Student: ((Refer Time: 12:44))

Plus! Why plus? Just a minute, it is the conjugative you see the denominator the denominator has 2 poles 1 is s minus s 1 multiplied by s minus s 1 star. And I have taken here s minus s 1 star have I made a mistake.

Student: ((Refer Time: 13:13))

This should be equal to s at this point minus 1 plus j root 23 divided by 6. I have made a mistake. You see the factor here was 3 s square plus s plus two; obviously, this should be s minus s 1 s minus s 1 star that factor 3 has to be there isn't that right no. So, the factor 3 has to be 3. I do not know if I had yes I had taken that into account fortunately. And if you substitute this it is not too bad.

Student: ((Refer Time: 13:56))

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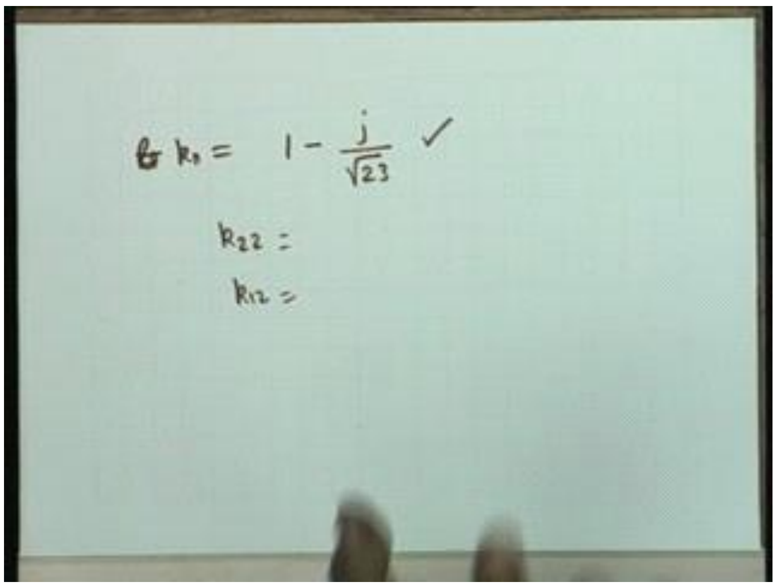

That means 1 minus j by root 23 is that right that mean this is equal to k11. If you simplify this, this is what is the result is I hope I am right. Similarly, now you have to find out k22 which I did not have the patience to I hope you shall have the patience to find out this balance. And it is not too bad because things cancel and you get nice things like it is not very nice, but not too bad. Square root 23 let it remain square root 23 ultimately you can show that the residue condition is valid. Any question?

So, bit of algebra, but 1 has to do it. We next go to 12.4.

Student: ((Refer Time: 14:51))

Similarly, you have to calculate for the other poles.

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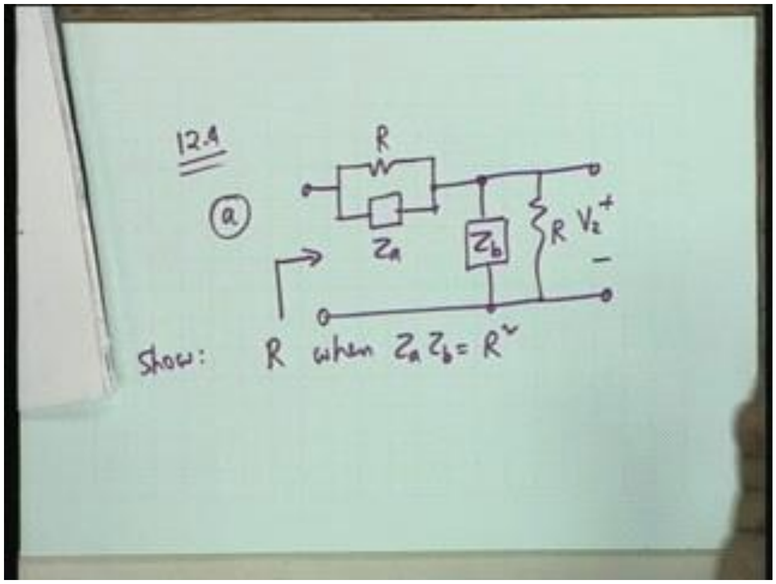

We next take up 12.4 it says for the networks in the figure show that the driving point impedances Z in are equal to R when Za Zb equal to R squared. You have to show let us take the a network R Za and Zb you have to show and this voltage is V2. You have to show that this impedance is equal to R show when Za Zb equals to R squared. Now, when terminated by R the input impedance is R can we call this a constant resistance network.

Student: ((Refer Time: 16:05))

No.

Student: ((Refer Time: 16:08))

No it is not symmetrical. Constant resistance network is 1 in which it does not matter which way you turn it. So, this is not a constant resistance that, but it is an interesting network that the input impedance is the same as the terminating at least in 1 direction. And this showing of this is not difficult at all.

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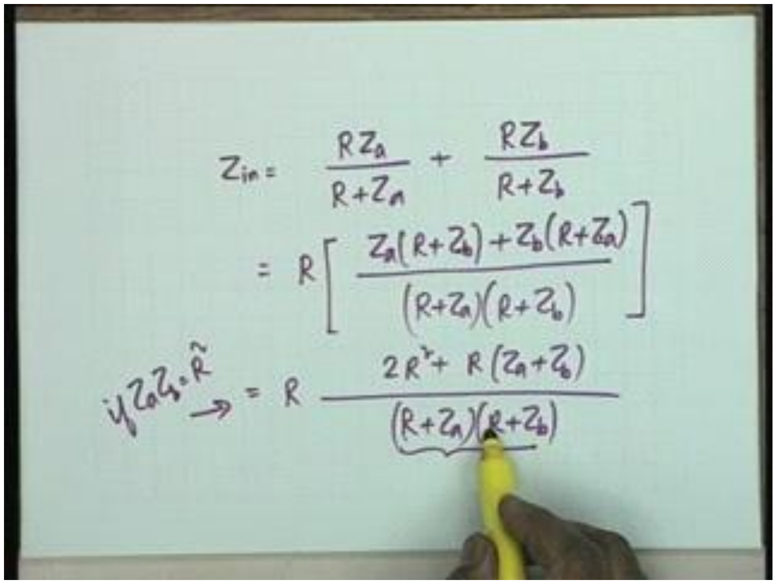

Input impedance is Z in is R Za divided by R plus Za plus R Zb 2 parallel combinations put in series R plus Zb. Therefore, this is R multiplied by R plus Za R plus Zb and in the numerator you have Za R plus Zb plus Zb R plus Za. That is equal to R R plus Za R plus Zb and in the numerator you have Za Zb which is R squared. Similarly, Zb Za that is R squared. So, 2 R squared plus R Za plus Zb is that. Za Zb if Za Zb equal to R squared then this step follows.

You see that the denominator is the same R squared plus Za Zb which is also R squared plus R multiplied Za plus Zb. So, this is simply equal to R. I am skipping an algebra a step similarly you can show about the other similarly. But they are not constant resistance network because they are not symmetrically nevertheless these networks are of interest. Our next problem would be 12.7 12.6 we all ready did in 1 of the problem sessions if you recall I think on LC networks LC network synthesis.

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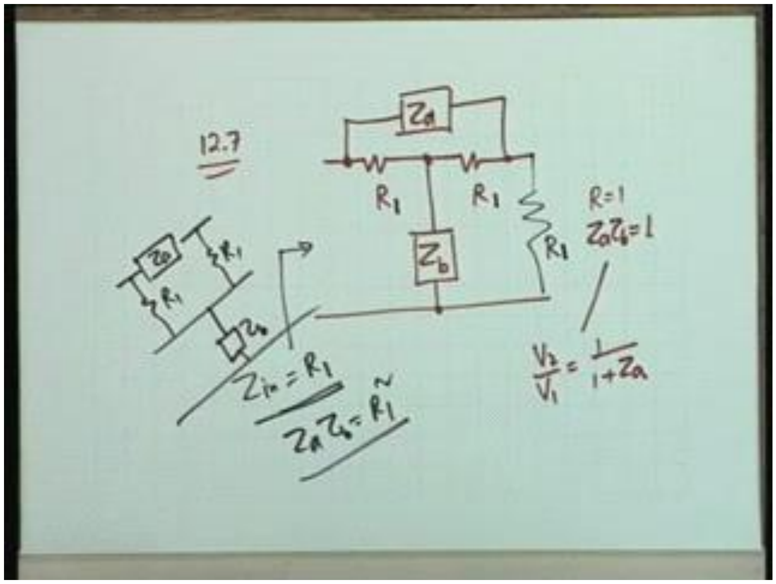

12.7 here is a constant resistance network it is a constant resistance bridged T circuit and the circuit is like this. R R you have a Zb and a Za this is indeed a constant resistance circuit and it says that if Za Zb equal to 1. That means you put R equal to 1 and Za Zb equal to 1. You have to show that under this condition under this condition you have to show that V 2 by V 1 is equal to 1 by 1 plus Za. This is this is what is to be demonstrated.

Student: ((Refer Time: 19:35))

I did not understand your question.

Student: ((Refer Time: 19:38))

Circuit this is the circuit draw the circuit.

Student: ((Refer Time: 19:45))

How do I know well it is given? So, that if Za Zb equal to 1.

Student: ((Refer Time: 19:54))

Well if it is R square then the input impedance is R1 can show let us show that first.

Student: ((Refer Time: 20:05))

All right so, if you terminate by R since it is a sym metrical network it would be true for the other also. What is the input impedance?

Student: ((Refer Time: 20:15))

That resistance or terminating resistance also that is the definition of constant resistance network. That if terminated by R yeah the internal resistances are also R.

Student: ((Refer Time: 20:28))

Yes it would be if it is R1 and R1 then the condition to be satisfied is Za Zb equal to R 1 squared. Then if you terminate by R 1 the input impedance would be equal R 1.

Student: ((Refer Time: 20:46))

One at the time yes. Then it would not be a constant no then the input impendence is no it would not be R2.

Student: ((Refer Time: 20:55))

In this particular network yes there maybe others in which the resistance is not part of the network yeah. Any other question, correct R is used to the network itself quite correct. What was your question?

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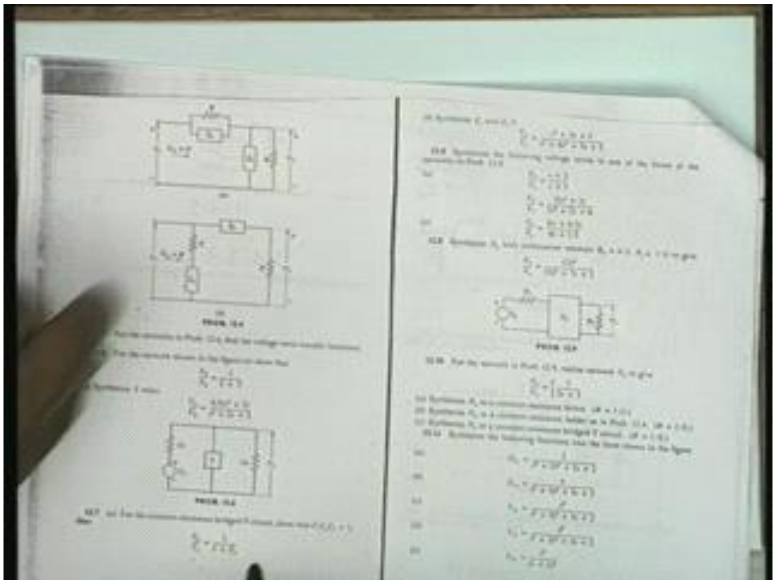

No more termination, termination is all ready there you have show that the input impendence for 12.4 second circuits you have to show that the input impendence is R.

Student: ((Refer Time: 21:42))

There is not other termination this is the network.

Student: ((Refer Time: 21:49))

There are not constant resistance the termination does not matter. But they are used in synthesis both of this networks you replace R by a second network of this type and terminate that in R you see what I mean.

Student: ((Refer Time: 22:08))

So, you can make cascades of this.

Student: ((Refer Time: 22:11))

You see you use another network R Za 1 then Zb 1 such that Za 1 and Zb 1 multiplied again gives R square. Can we go back to the question? How to do show what, what procedure do you follow to show that Z in equal to R1. What procedure?

Student: ((Refer Time: 22:39))

You convert this T into pi and then combine with this Za then you write the input impendence is that the only method. Anything else?

Student: ((Refer Time: 22:53))

We did not assume it is given.

Student: ((Refer Time: 22:59))

That is R equal to we have not proved yet.

Student: ((Refer Time: 23:07))

It is not been stated that way. But this is a property of the network that if it is terminated in R 1 then the input impendence is R 1 and the condition for that is that Za Zb equal to R1 squared. Which fits in here, which only means that, R is equal to 1. This can be shown I will skip that part shall I?

Student: ((Refer Time: 23:31))

Is there any other method to show this that the input impendence is R, instead of converting this T into a pi can you think of?

Student: ((Refer Time: 23:43))

No, what I was saying is you could also consider this you could also consider this as a pi and then as Zb you could do that. Convert this into a T what you said convert this T is into pi and combine with Za I could also convert this pi into a T and combine with Zb. So, whatever method you follow, there is no more resistor you have to ultimately connect this ultimately you have to connect this resistance.

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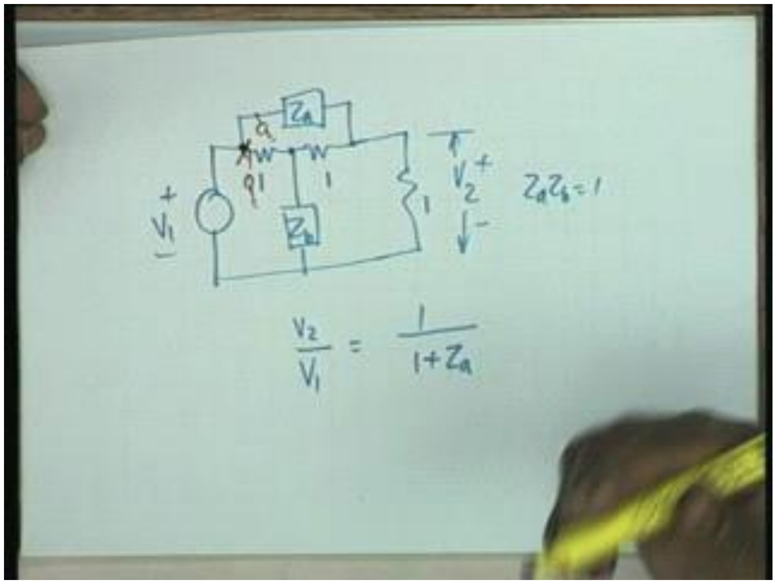

But let us go to the transfer function problem. You have to show that if 1 one Zb Za and this is terminated in 1 ohm this is V2 and this is V1. The problem is to show Za Zb is equal to 1 problem is to show that by V2 by V1 is 1 by what is it 1 plus Za. You can do it the in the same manner that you did you can convert this into a pi combine with another pi then find out the transfer function.

So, on to bring variety into experience let us do in a slightly different manner. You remember I pointed out that if there is a voltage source connected to 2 networks you can you can think of this is a 2 networks in parallel then you could split the voltage source. That is you could you could spilt this connection and connect a voltage source V1 to each network. Let us see if that gives us any simplification you understand what I mean.

If I disconnect it here and then connect a V1 here and connect a V1 here it is not change in matters remains identical, but it solves the network almost by inspection no calculation was needed.

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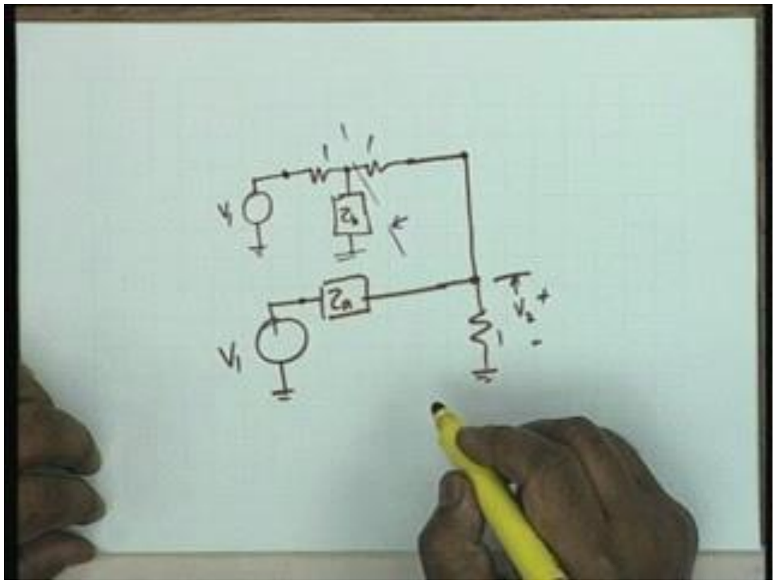

Look at the simplicity. You have a V11 1 Zb then you have another V1 which is simply connected in series with Za and the whole thing is connected here and connected to a 1 ohm resistance and this is V2 all right.

Student: ((Refer Time: 26:51))

No I did not follow.

Student: ((Refer Time: 27:09))

That is what I did isn’t it isn’t it 1 ohm then 1 ohm Zb that is what I did exactly the same thing. But I have to make sure that the potential of these 2 points are the same that is all that I require right potential is V1. Now, you see as far as this network is concerned it can be solved almost by inspection because if we apply Thevenin's theorem here. Then the equivalent would be V1 Zb divided by Zb plus 1 equivalent voltage source and the equivalent internal impendence would be 1 into Zb divided by 1 plus Zb.

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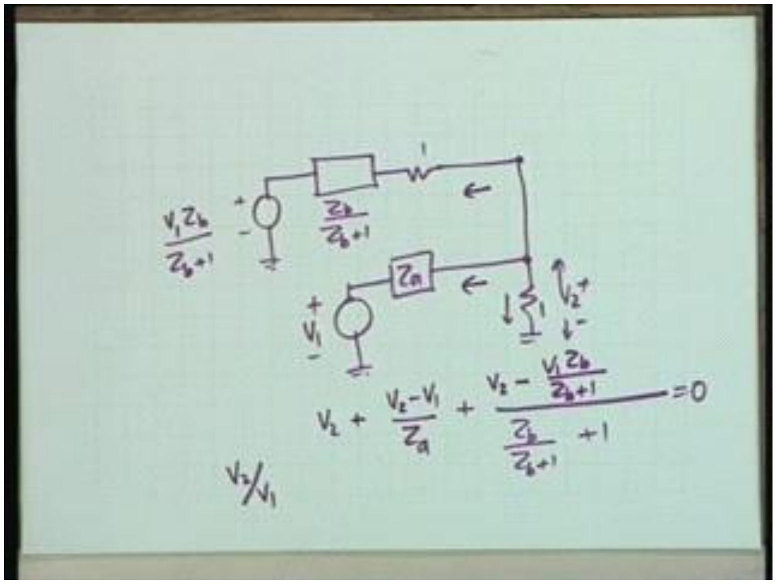

So, I can draw this by inspection V1 Zb by Zb plus 1 plus minus then this impendence is Zb by Zb plus 1 then you have a 1 ohm. And the other 1 is V1 Za and this is connected here the whole thing is connected to a 1 ohm and this voltage is V2. All that you have to do now it is right 1 node equation that is V2 V2 by 1. This current plus V2 minus V1 by Za this is the current in this direction.

The current in this direction would be V 2 minus V1 Zb divided by Zb plus 1 divided by Zb by Zb plus 1 plus 1 equal to 0. That's all no conversion no formula nothing to remember it is just 1 application of Thevenin's theorem.All that you have to do now is to simplify this to find V2 by V1. You can very easily show that under the condition that Za Zb equal to 1 this is exactly 1 by 1 plus Za any question.

These are some of tricks that 1 exercises this you will not get this in a textbook and it is commonsense. I have also cautioned you that, had the input been a current source. The procedure would not have been valid have I or have I not current source cannot be split like this. Number 2 if this voltage source had a nonzero internal impendence then also we could not do this. It is only in the case of a ideal voltage source that we can do this that you can split not otherwise.

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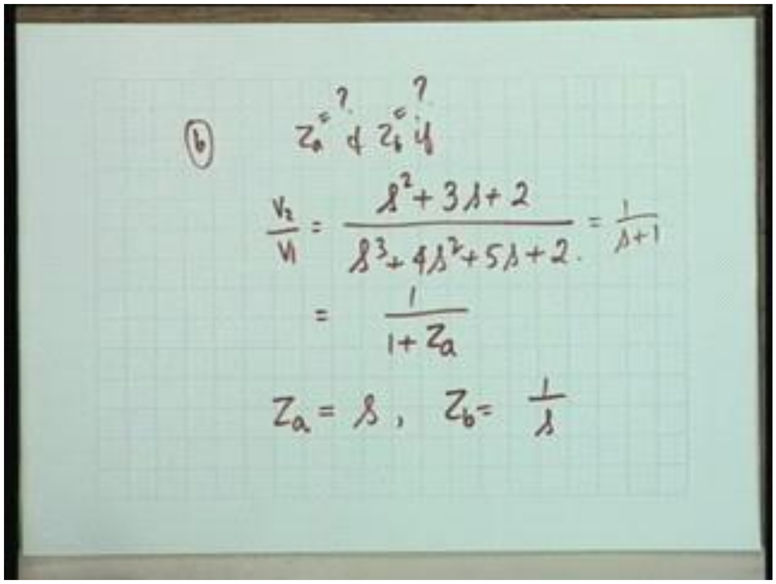

Part b, Part b says synthesize Za and Zb if V2 by V1 is equal to s squared plus 3s plus 2 divided by s cubed plus 4s squared plus 5s plus 2 all right. All that you have to do is to equate this 2 1 by 1 plus Za and then and then find out Za. If you do carry out the algebra very surprisingly Za turns out to be equal to s can you tell me why can you tell me why this is s? If this is s then; obviously, the transfer function will be 1 by 1 plus s.

Student: ((Refer Time: 31:31))

That is correct these 2 polynomials are not primes with respect to each other. In fact, it can be shown that this is 1 by s plus 1. If Za is s then what is Zb; obviously, 1 minus and this synthesis is complete this transfer function is a degenerate transfer function that is why it is so?

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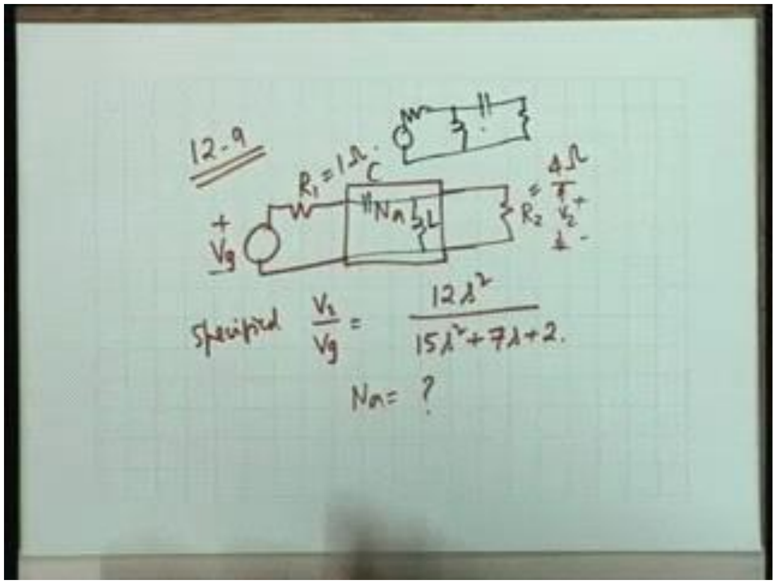

Our next problem is twelve nine we are taking only nontrivial problems most of the others are trivial. 12.9 says synthesize the 2 port NA now, it is not singly terminated it is doubly terminated it is terminated on both sides. This is V 2 and there is a voltage source Vg in series with a resistance it is not pure voltage source it is not an ideal voltage source it has a resistance. That means there is termination here termination here also such a network is called a doubly terminated 2 port.

We have not learnt this synthesis despite that the question asks synthesize Na with termination resistors R2 equal to 2 four ohm. And R 1 equal to 1 ohm to give V2 by Vg as equal to twelve s squared divided by fifteen s squared plus seven s plus 2 this is what is specified you are require to find Na all right. There are 2 terminations the first thing any suggestion as to how to proceed. Those nice procedures Z21 you divide by the odd or ever part that does not hold because you have a termination on both sides.

Student: ((Refer Time: 33:37))

We can find out input resistance here how does that help?

Student: ((Refer Time: 33:46))

So, how does that find NA?

Student: ((Refer Time: 33:55))

No, you may mean I convert this into a current source and transfer this resistance over the network Na I am not allowed to jump no. That will destroy the complete network you cannot ignore Na the effect of Na it is an insertion network. Any other suggestion?

Student: ((Refer Time: 34:23))

Why aren't you are thinking in terms of Na? What is the possible structure of Na? What is the possible structure how many zeros are there transmission zeros 2 and both of them are at the origin. So, it must be a very simple network can you guess what the network would be a series capacitor and shunt inductor that is it. A series capacitor and a shunt inductors this is C this is L. Can we have it the other way round can we have L here and C on the other side.

Student: ((Refer Time: 35:07))

Why not?

Can we have like this? Because we do not have an ideal voltage source or an ideal current source we have a resistance here. So, there is no reason why this should not work all right. So, either of these 2 networks would work. Let's choose 1 of them.

Student: ((Refer Time: 35:37))

Single resistance termination we have because there is a pure voltage source a pure current source.

Student: ((Refer Time: 35:37))

No here both of them will work because there is a resistance here.

Student: ((Refer Time: 35:43))

Correct.

Student: ((Refer Time: 35:49))

For both say for...

Student: ((Refer Time: 35:52))

Yes, that is certainly true we will find out the parameter, but in a heuristic manner there is no set rules for this.

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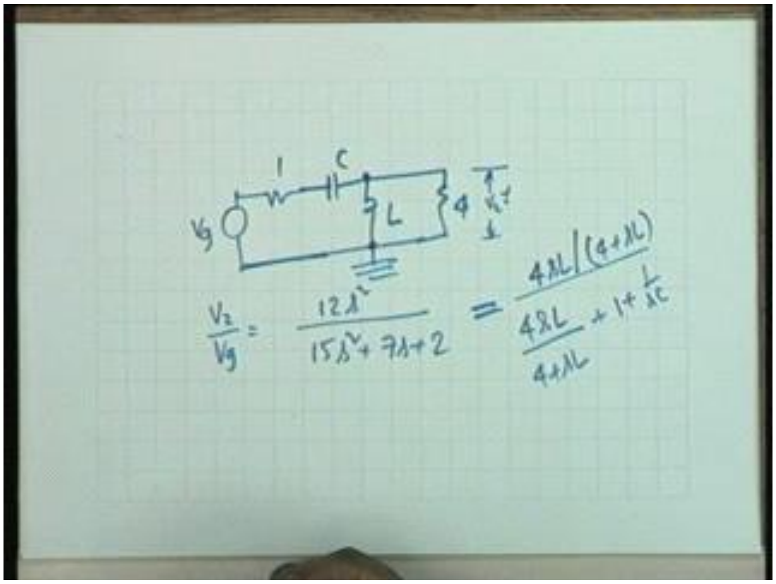

Let us see let us see what our Vg and then we have 1 ohm let us take this C L.

Student: ((Refer Time: 36:16))

Um it does not matter I have to calculate V2 by Vg.

Student: ((Refer Time: 36:23))

Yes, of course, 2 transmission zeros at the origin there is no other way these are the only 2 ways. So, this is V2 and V2 by Vg is given as twelve s squared divided by 15s square plus 7s plus 2. 1 step is done that we have guessed the structure correctly hopefully the next step is to find the values. 1 of the ways 1 of the things is simply write V2 by Vg is the simple enough network isn't it. 4s L divided by four s 4s L divided by 4 plus sL 4 sL divided by 4 plus sL plus 1 plus 1 over sC agreed.

Simplify this is this point clear. This impendence divided by the sum of between this is a potential deviation and then equate the coefficient you will get L and C. This is the simplest matter you can do it by any other methods also, but this is the simplest 1. This is simplest 1 because it is simply a potential division you did not have to write loop equation or load equation, but suppose it was not so. Suppose it was not. So, suppose it was more than 2 loops more than 2 elements.

Suppose, there was there was a third element or the fourth element even then 1 should not disheartened because 1 can work with a latter you start with V2 and go back. You can find out the transfer function easily. Is this making sense what I am saying?

Student: ((Refer Time: 38:29))

This is what 1 should do. Yes? that is what 1 should do, our last problem of the day.

Student: ((Refer Time: 38:37))

We have assumed what?

Student: ((Refer Time: 38:42))

Yes

Student: ((Refer Time: 38:44))

There can be resistor here oh I will bring it here wherein this loop it does not matter where that resistance is put. This is the most favored type of circuit in which the input and output have a common ground that solves many of the electromagnetic interference problems. So, this is this is the type of network that we usually prefer that is why we have chosen this.

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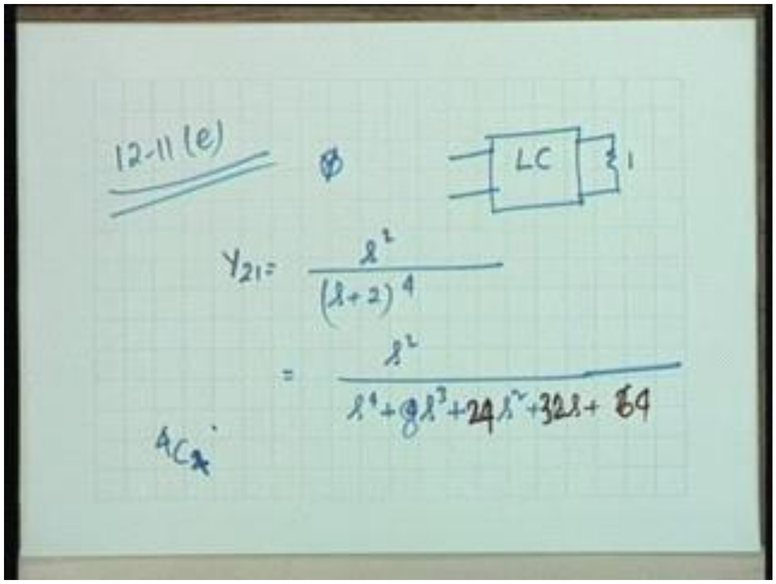


Our last problem of the day would be twelve eleven we will solve the most difficult 1 e 12 11 e. The problem is to synthesize the following function in the form shown in the figure. That is we have to synthesize the given function in the form of an LC network terminated in the resistance of 1 ohm.

Student: ((Refer Time: 39:55))

Terminated in the resistance 1 ohm, see the next page problem 12 11 see that problem twelve eleven this is the network given. And the function is y21 equal to s square divided by s plus 2 whole to the fourth its perfect perhaps the toughest all this. So, what we do is first we write the denominator binomial expansion. We shall have s to the fourth plus 4s cube can you guess what the next 1 would be.

Student: ((Refer Time: 40:37))

Now no

Student: ((Refer Time: 40:41))

4C2 multiplied by 2. So, it would be 12s squared. What is the next 1?

Student: ((Refer Time: 40:52))

16 that is correct, 4 C 3 multiplied by 2 squared. No this is binomial this is binomial.

Student: ((Refer Time: 41:02))

Why 8?

Student: ((Refer Time: 41:07))

2 what is 4C2 no 4C1.

Student: ((Refer Time: 41:16)

Is 4 you are right I made a mistake is this no.

Student: ((Refer Time: 41:30))

No.

Student: ((Refer Time: 41:30))

16s plus.

Student: ((Refer Time: 41:34))

Bad, is it that bad?

2 to the 4

Student: ((Refer Time: 41:42))

Is this 32 is this 32 all right.

Student: ((Refer Time: 41:48))

What is 4C2 12.

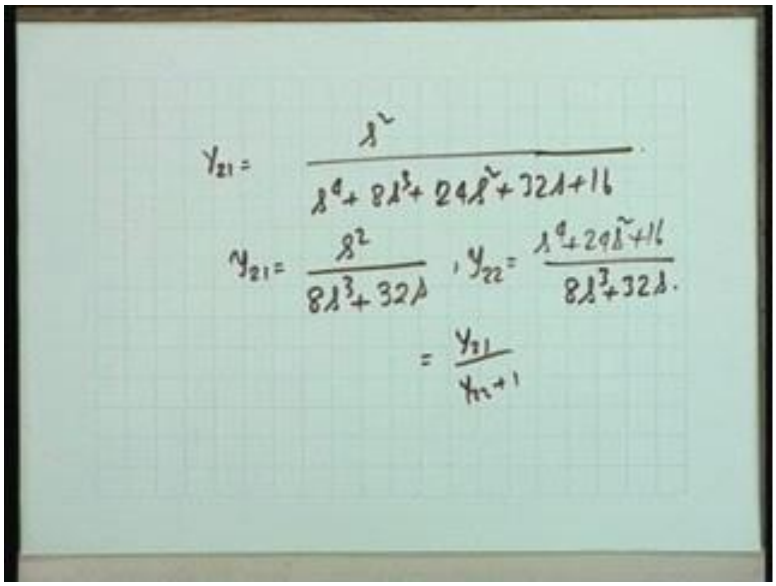
Student: ((Refer Time: 41:54))

32 is all right this 24.

Student: ((Refer Time: 41:57))

No, we should not be stuck at such simple things this is too quite far from the network.

(Refer Slide Time: 42:05)



24s squared plus 32s plus 16 now. So, what should be our y21s squared divided by either s cubed plus 32s. And y22 should be equal to s 2 the fourth plus 24s squared plus 16 divided by 8s cubed plus 32s all right.

Student: ((Refer Time: 42:37))

We have taken 1 out that is how we will get y21 by y22 plus 1 we are diving the even part by the odd part that is how we get 1 plus y2. The point that I wish to now I wish you to consider now is where are the transmission zeros; there are 2 at the origin.

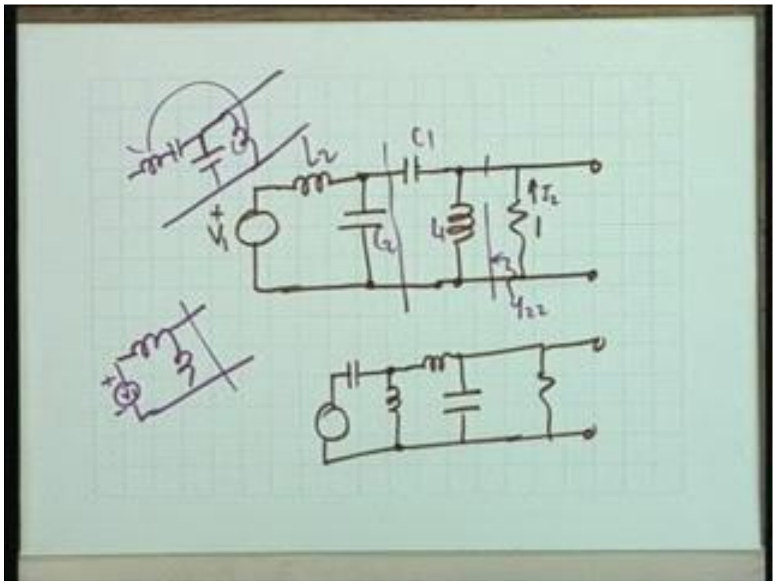
Student: ((Refer Time: 43:12))

2 at infinity, at infinity it is of the form s squared by s 2 the fourth. So, what should be the structure? Once we know the structure then we would be able to get the network 2 at the origin?

Student: ((Refer Time: 43:29))

That is fine at s equal to minus four poles transmission zeros are 2 at the origin and 2 at infinity.

(Refer Slide Time: 43:45))



Now, 2 at the origin mind you we are developing y22. So, we start from this end.2 at the origin 1 can be an inductance in series all right and 1 can be a capacitance. Inductance in parallel in shunt and a capacitance in series this 2 will take care of 2 transmission zeros at the origin. Then the question of infinity what should we have here?

Student: ((Refer Time: 44:13))

A capacitor in shunt and an inductor in series, the last element is a series element because voltage source this is V1 and this is a termination of 1 ohm. And this voltage, it is not the voltage it is the current I2 that is the our concern.

Student: ((Refer Time: 44:42))

Good question. Why do we why you wanted me to take the infinity first?

Student: ((Refer Time: 44:58))

Yes, we could to that. So, we could have done this like this is also a perfectly valid the element values shall be different. Then what then I should have an inductance and a capacitor this is perfectly all right.

Student: ((Refer Time: 45:17))

No I did not understand what you said.

Student: ((Refer Time: 45:22))

1 1 at a s equal to 0 1 at yes any structure which make sense is perfectly all right. Now, question is how do we develop this structure now? What you have to do is to develop y22?

Student: ((Refer Time: 45:42))

If we have 3 zeros at the origin we would have another inductor here.

Student: ((Refer Time: 45:51))

My another inductor in shunt and a pole at.

Student: ((Refer Time: 45:59))

Correct.

Student: ((Refer Time: 46:02))

No 2 inductors at the start here that should not be it should not be allowed because its equivalent 1 inductor that you have to check.

Student: ((Refer Time: 46:16))

You see I could not have something like this as I had discussed in the class why because this is equivalent to 1 inductor. If I take the Thevenin equivalent it will be constant multiplied by V 1 plus 1 inductor any other question.

Student: ((Refer Time: 46:38))

Can the capacitor and the inductor be which capacitor and which inductor these 2.

Student: ((Refer Time: 46:42))

Yes they could be in series.

Student: ((Refer Time: 38:49))

Can they be together? Yes that is what I mean they could be together provided you could put the other 1 in proper position.

Student: ((Refer Time: 46:59))

No if 2 capacitors are in series that is equivalent to 1 capacitor.

Student: ((Refer Time: 47:03))

No, but I could have something like this I could have something like this that is not equivalent to 1 capacitor. Any other question before I says the about the synthesis.

Student: ((Refer Time: 47:25))

2 transmission 0 at infinity this and this and 1 at the origin

Student: ((Refer Time: 47:38))

Correct that can also be a perfectly valid structure surely why not this is also perfectly valid structure. If there is 1 solution to a synthesis problem there is an indefinite number of solution, but of course, solutions have to be reasonable I mean they have to satisfy the original facts. Now, go back to this question how do you develop y22 now. Obviously, 2 steps of cover 2 then changeover to 2 steps of cover 1 right. If you want to develop this for example, then 2 steps of cover 1 followed by 2 steps of cover 2.

You have to be very careful there is a blind method also you do not know cover you do not know you do not know cover 1 cover 2.

Student: ((Refer Time: 48:39))

That's right you continue to remove the poles there is still another suppose you do not know how to remove poles, but you know network analysis. You give it a first year student who has not done any synthesis. So, far how will he do it he will assume that this is L1 C1 C2 L2 blindly analyze this and then equate coefficients. 1 could also do that that is very lengthy procedure synthesis gives you a simpler tool more tomorrow.

Thank you.