Experimental Physics - III
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Lecture - 04
Cathode Ray Oscilloscope (CRO)
(Continued)

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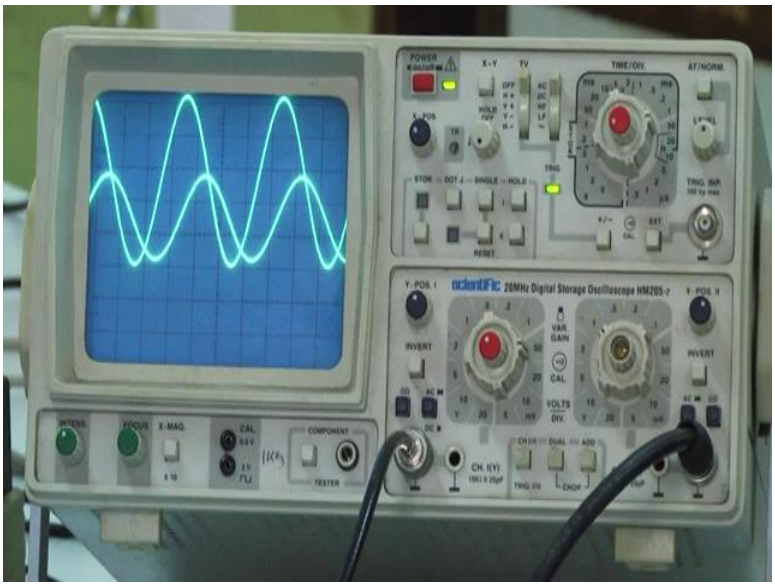

Let me this is the one whether this channel 1, this is the channel 2 this signal Now, for channel 1 I have to check that everything is fine, but it is not coming it should come; it should come in principle there should not be problem channel 1 is showing this signal it is triggered, you see this is the auto triggered; I have put in auto triggered. Now, channel 2 I have taken the same signal to the C R Circuit R C circuit and putting channel 1, but I am not getting I think this. it is not triggered; this problem you see this is a not lightened.

I think I have to change the triggering level ok, I am go this mode I will change the triggering level you know. I have to change the triggering level to see signal is not triggered let me I have to see what is the it is ground this is A C or D C this is fine, but problem is this A C or D C, but I have kept in A C mode this is the but it is not able to trigger this one.

but it is not yeah sometimes you have to find out whether where is the problem? things are not very straight forward one has to really find out you know channel 2 fine it is

coming if I use this one in channel 2, what will happen no this same problem. the I think this is the problem with C R O no yeah triggering problem, not C R O I think this. this out to triggered it is nicely being coming now dual beam ok I think this problem is the timing. I have to know to 1 I have to select this one.

Student: Why?

No it should trigger triggered properly no. this triggering normal and or I can set level. I think their auto triggering I have kept at normal means; it will trigger automatically. I this is fine, this is fine, both are coming this is fine frequency also same. it should not be the difficulty. Dual mode omits x y ok, it is coming it is there it is triggered this channel 1, but channel 2. one has to find out so; that means, signal is going there, signal is there oh.

Student: (Refer Time: 06:45).

It is this for this now it is there some problem was there in connection anyway. now, is let me check channel 1, this one channel 1. this signal is coming 2 or 3 channel 2 this one, now you can see same signal, now dual 1 if I use, interestingly you can see, that same signal ok, their frequency same in dual mode I have seen. sorry not this one, this one ok, this is at 1 and this is at 50 and that to channel 2 ok.

this is at 1 volt this original signal and another signal coming via R C. that 1 is here I kept at 0.2 0.1 this 50 50 millivolt and this other one is this bigger 1 is at 1 1 1 bigger 1 is 1 volt and this one is say 50 millivolts ok.

amplitude here we have selected 5-volt peak to peak, but here you can see that is because of it is just coming through the R C Circuit It is amplitude is attenuated is reduced, but frequency of both signals are same frequency of both signals are same, you can see they are just both I have there same (Refer Time: 09:14) with that I can ok, this in dual mode I cannot shift.

Anyway that showing their phase difference between these two phase difference between these two and, they have same (Refer Time: 09:44), but phase difference between these two and, their amplitude is different although originally the amplitude same that is region

just I told you that one is directly going and another is coming through a R C circuit. it is amplitude reduced ok.

Now, and initially it was same phase, now it is different phase because it that is why to make the phase difference from same source, we have, we have, we have introduced this R C circuit.

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Now, you know that, what will be the phase difference in R C circuit, R C circuit this I think 10 phis equal to 1 by 1 by omega R C, 1 by omega R C ok, 10 phis equal to 1 by omega R C probably minus sign will be there now, 1 by omega R C you can if you change either C or R or omega or omega, then you can see the phase you can introduce the phase you can introduce the phase change in the signal ok.

in this circuit I do not have option to vary the R or C ok, but I have option to vary the omega here ok.

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I will just vary omega and show you this, but this I cannot do this as I showed that there will be variation of the there will be variation of the omega. due to that variation, due to that variation here ok, no it is a quite stable ok.

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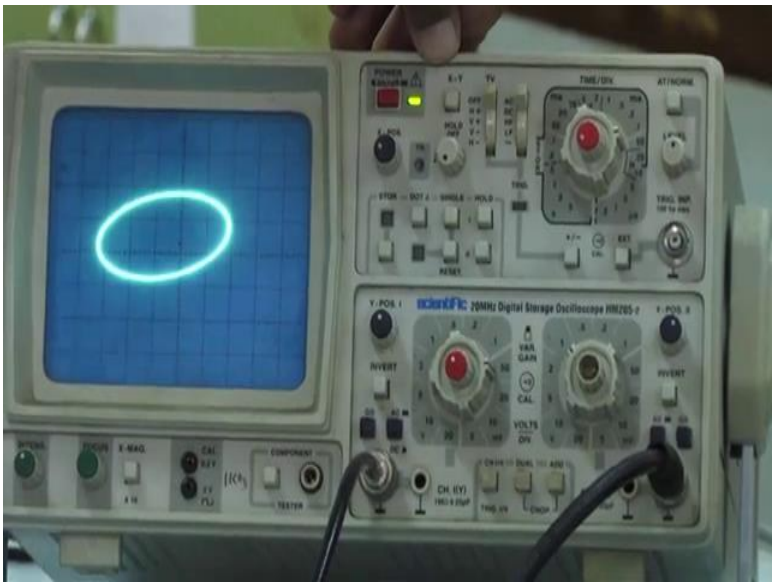

Since, it is from same source as a now you see, now you see as I told del omega del omega it was just slight difference source I was using different source I was using. that is what I was I told you that is the whatever reading I am seeing, that is not exactly there is

a slight difference. that is del omega. then del omega t. with and there will be phase change, that is why it was moving.

Now, exactly it is stable you see it is exactly stable because omega an and omega b omega 1 and omega 2 they both are same, I am taking from the same source. Now, if I change one is coming direct and another coming by R C as I told these I can introduce phase change ok, just varying either omega or R or C. here I do not have option to vary the R or C, I have option to vary the frequency means omega.

I will go in that option I want to vary the frequency ok, but very small. then there will be phase introduced let me just change by I think in I will change let me check and then show you. I am changing frequency you see, I am changing frequency, I am changing frequency it is it is getting changed, but I do not know I have to change more probably is there any change no I do not see any change oh this in this figure.

I am changing frequency omega ok, that is why there is a change of phase of one signal compared to other one, because whatever frequency change is there that is because both frequencies will remain the same and only phase additional phase is introduced here. that phase depends on omega R and C, I am varying here omega because I do not have option to vary R or C ok.

with that I am showing here you the this is the change ok, change of frequency here means here change of this, but I could change here ok, but it is not much sensitive, because frequency I have chosen very high. that is why anyway. I think at lower frequency if I choose lower frequency for the experiment, then maybe that change will be sensitive this change will be sensitive; that means, I should go to the that level then you can see the change.

I am introducing the phase introducing the phase in one signal. ok then amplitude is different. circle you will not get ellipse you will get ellipse you will get this is the, this phase change is very sensitive to this to this R and C, you have to take proper value. with phase change they are able to change with phase change we are able to change this ok, it is a straight line, but very straight line it is going towards the other. I do not have proper arrangement to show you that one, but whatever by intention, that I was able to show you.

you can measure the phase. for measuring the ratio of this measuring the ratio of this of this an axis and b axis major and minor axis of ellipse ok, from there you can find out the phase. phase difference between the two signals now this is for same this is for same frequency. Now, for different frequency what happens let me show you this? here I have to go let me take very for small frequency, because I have to used for two signal I have to use to these for changing the frequency

I will not use this one directly I am using these signal. I would like to take lower frequency for this experiment say, because if higher frequency problem is as I told that this there is a slight change this if slight frequency difference is there, that will create this movement of this of this Lissajous figure or small value of this. I think maybe may let me take 30 kilo Hertz and, for this 30 hertz signal I have not x y mode I am choosing not dual mode I am choosing this is channel 2 I am choosing channel 2.

Now, voltage it should be 5 volts, no triggered it is triggered properly ok, there let me signal is here time base because no one has to work. it is triggered time base Now, I think it is not triggered this is triggered and, second signal I will take from here, second signal I will take from here ok, time base I have to change because it was 5 kilo Hertz and then I am changing to 30 Hertz only everything one has to be careful, otherwise you will not see the signal and then we will blame that either this problem that problem.

then I have to make it alit want to make it also this frequency, frequency change 30 Hertz oh it is say increasing up no decreasing, it is say frequency it will go no some increasing decreasing no 1 kilo Hertz, then I think I have to check here, I want to change 90 Hertz, 80 I want to change the 30 Hertz, I have to go there yes 30 Hertz. this also this 30 Hertz and that 30 Hertz it is say high volt is now, these earn for channel 2 now channel 1 it has come it has come I have to I think I have to hold it I have to hold this signal so.

Student: (Refer Time: 23:24).

Student: (Refer Time: 23:33).

That type of fluctuation will be there.

Student: (Refer Time: 23:38).

Anyway. let me see. slightly I can increase the.

Student (Refer Time: 23:48) 90 50 will be (Refer Time: 23:50).

50 Hertz let me change to 50 Hertz ok, when this also I will change to 50 Hertz change frequency make some make 50 Hertz, 50 Hertz I think anyway. I am not able to fix this oh it is in dual mode when I say dual mode I should see both, but I am seeing one it seems channel 1 ok, channel 2, channel 1 and channel 2 I think yeah both are there it seems. dual mode I am seeing there should be to light shifting maybe yes. it was exactly matching. towards there, but I and.

Student: Time scale (Refer Time: 25:23).

Time scale, oh I think this maybe.

Student: (Refer Time: 25:36).

It is a line frequency that is maybe, because of that Now, I will use two of same frequency 2. x y mode x y mode same frequency and they are it seems as in higher frequency I was seeing some change del there was slight change there is a difference of del there is the omega. Now, here del omega frequency is very small it looks it is an if slight change is there also that is in Hertz not in kilo Hertz. I am getting for same frequency I am getting this.

Now, I will change make frequency just one of them double ratio 1 is to 2. then let us see what happens I want to change the frequency of this channel 1 ok, then what you will see just check it I want to change the frequency. Now, I want to make it 100, I am changing I am changing 100.

Student: Ok.

Now, I have to introduce this one, I have change the introduce this one Now, this is 100 and this is 50.

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You see frequency of 1 is it is a form here you can see it is not same, but if they are I have to into this say as I told ok.

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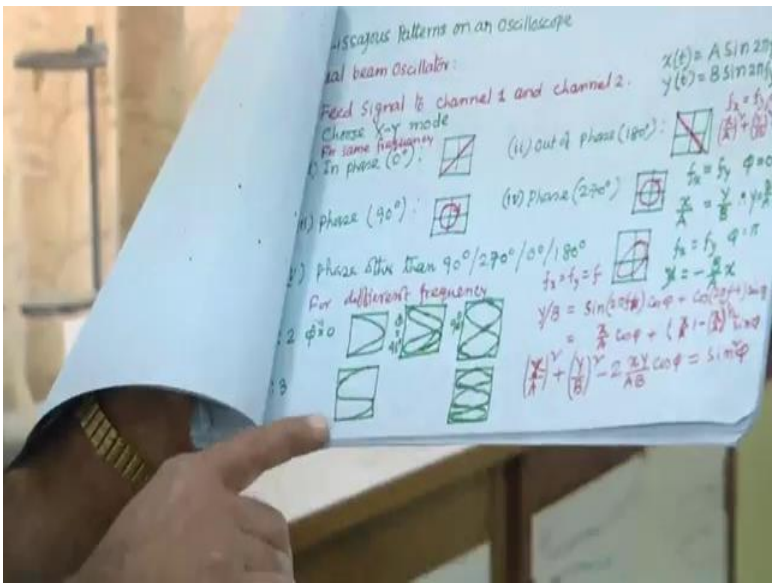

As, I showed you this picture, where as I showed you this picture, now it is inverted you know that I can do if this actually change which signal 1 and signal 2, channel 1 channel 2, if I extend just it will be in along the other direction. Just let me exchange it channel 1 and channel 2, then what about the figure I have drawn in the in this here you will get the

same way what about the way I have (Refer Time: 28:15) drawn the figure ok, you will get the same way ok.

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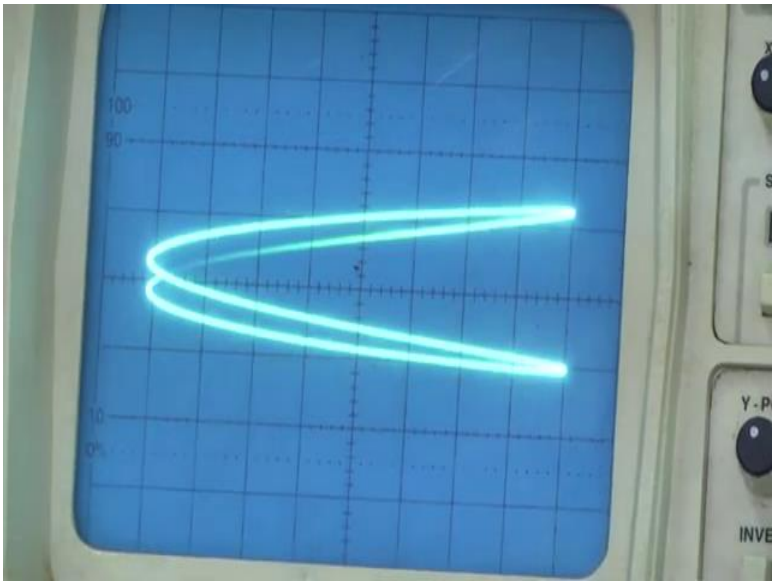

2 loops; 1 is to 2 frequency difference 2 loops 2 loops If I now, I am not able to; I will not be able to change this phi, you know phi equal to 0 or phi equal to 45 or 5 equal because I do not have option to change like this. only here whatever the initial phase difference between these 2 that remain constant that is why I was getting when same frequency I was getting it is the it is the when it is 45 this kind of. it is the around 45 between 0 and 90 degrees between it is between 0 and 90 degrees around then this type of shape you will get.

Now, I will change the frequency and let us see what happens? I will change the frequency 1 is to 3, 1 is to 3, 1 is to 3 150 ok, you see 3 loop 1 2 3 loop 1 2 3.

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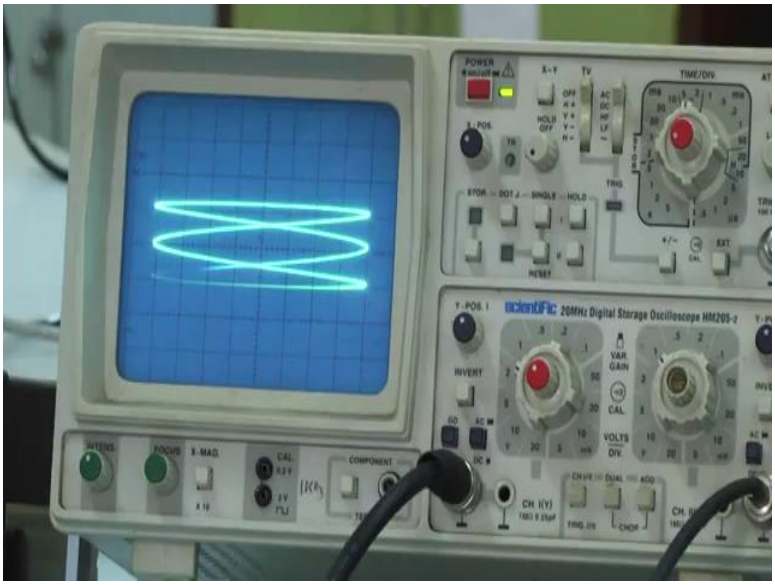

If, I 2 is to 5 then what happens this is 150 and a 102 is to 3, then what will happen just check it just check it I will make it 100 I will make it 100.

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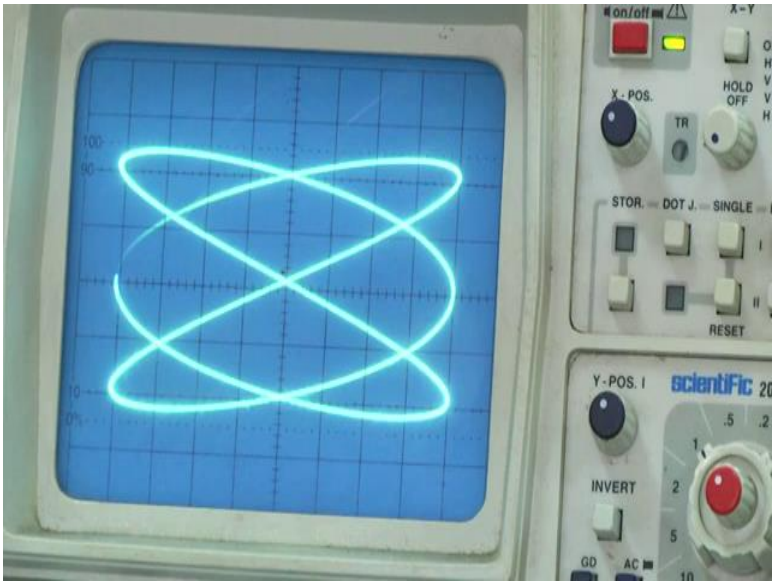

You see, I think 1 has to how I can expand it that is it? 3 loop and others way 2 loop different type of Lissajous figure you will get depending on the ratio of this. this is related with the number of loops you will find here ok, this ratio depends on the number of loops ok.

just here I showed you these ways from Lissajous figure you can find out the frequency ratio of this 2 signal, if frequency of one signal is known then find you can find out the other one. And, also for the same signal for 2 signal frequency same if phase difference is same phase difference are different what is the phase different that also you can find out ok.

this is the how to find out the phase difference between 2 signal? How to find out the frequency of a signal frequency difference of the 2 signal? that using the C R O we can measure that one, but we are not using C R O to just like measuring like this, there are some experiment where some property some property ok, because of some property phase changes, if I can measure the phase change, then actually I can started the property there how to measure that question then we use this C R O, for measuring that one, but purpose is not measuring these phase difference, if I can measure the phase difference then I can extract some other information.

to this I try to tell you how to use the C R O you know, but even it is complicated for me it is complicated for me because I am not always using this one Occasionally sometimes using but you have to know each and every function of this knobs. most of them I showed you for simple experiment, but there is other application also how to measure the rise time, fall time of a signal There are many ways there are people use this one ok.

if you know this some basic function of these most of the knobs, then confidently you can use this C R O because this is the basic instrument, when I was using I also facing some problem all the time it happens in experiment whether cable is cable connection is not or this meter is not one has to identify, where is the problem? Here, I identified as I told that this knob this frequency whatever there it is showing it is correct most of the information I tried to give you that you can use the C R O in lab confidently.

Thank you for your attention.