Expirement 7 :-

Damped Oscillations

- In this Circuit :-

$V_c = V_m e^{-\lambda_\pm t}$ → decay Constant

$\lambda_\pm = -\frac{R}{2L} \pm \sqrt{\left(\frac{R}{2L}\right)^2 - \frac{1}{LC}}$

There are 3 Cases :-

↳ Critical Damping :-

if $\left(\frac{R}{2L}\right)^2 = \frac{1}{LC}$

- $\lambda = \frac{R}{2L}$
- $R_{critical} = 2\sqrt{\frac{L}{C}}$

- In our expirement :-

$L = 5m\,H$

$C = 5n\,F$

so $R_{critical} = 2000\,\Omega$

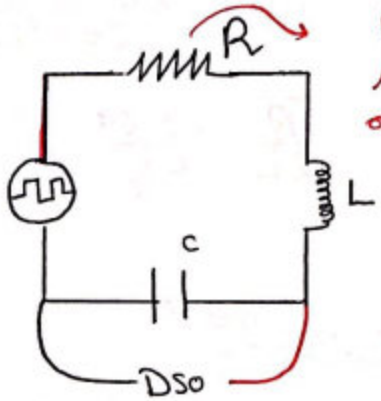
↳ Over damping :-

if $\left(\frac{R}{2L}\right)^2 > \frac{1}{LC}$

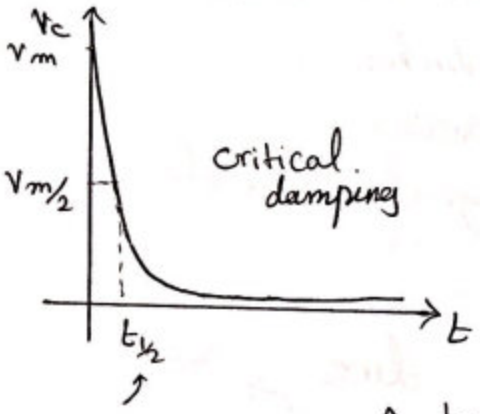
so $R_{over} > R_{critical}$

$\lambda = \frac{R}{2L}$

Dampeed Oscillations :-
oscillations that fades away with time



R increases the decay of the oscillations

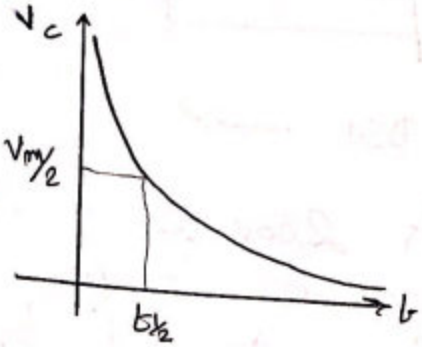


- $\frac{V_m}{2} = V_m e^{-\lambda_\pm t_{1/2}}$

$\frac{1}{2} = e^{-\lambda_\pm t_{1/2}}$

$\lambda = \frac{\ln 2}{t_{1/2}}$

$t_{1/2} = \frac{0.69}{\lambda}$



↳ Under damping

$$\left(\frac{R}{2L}\right)^2 < \frac{1}{LC}$$

In our expt:- $R < 2000\ \Omega$

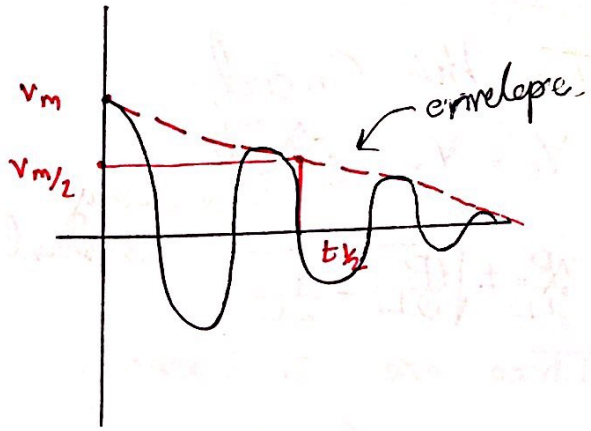
Here

$V(t) = V_m e^{-\delta t} \cos(\omega t + \phi)$

δ → decay constant

$R_{circuit}$

$$\delta = \frac{R}{2L} = \frac{0.69}{t_{1/2}}$$

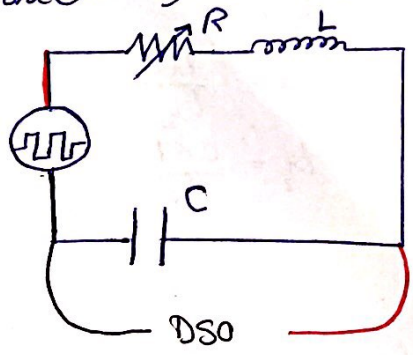


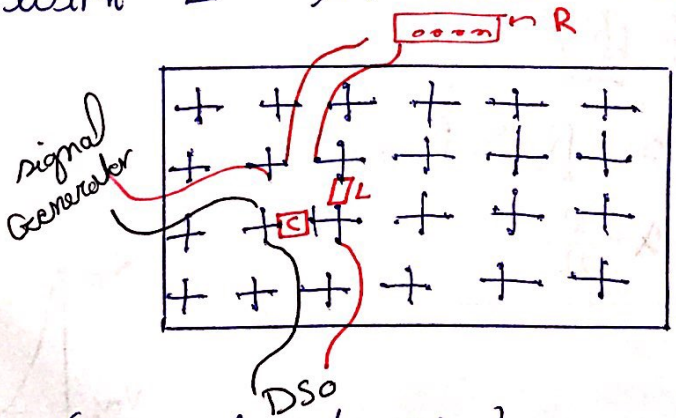
- what we use :-
  - Resistance decade box :-
  - inductor
  - Capacitor
  - signal Generator
  - Dso

Procedure :-

① Box

- Connect R, C, signal Generator and L
- Connect the Dso with L As shown here :-





- set R As 2000 Ω (critical damping) to obtain the Geraph
  Calculate λ and $t_{1/2}$

② Connect the same Circuit But set $R > 2000\,\Omega$ (over damping)
obtain the Geraph & funel $t_{\frac{1}{2}}$ anel λ

③ Connect the same Circuit But set $R < 2000\,\Omega$
in this Case We took R off (so $R = R_{circuit}$)
Draw the envelope on the Geraph anel . find .
δ and $t_{\frac{1}{2}}$ Then Calculate R circuit

① . قم بوصل الدائرة كما هو مطلوب (خيل C مع Dso)
. غير R الى 2000Ω و قم بايجاد λ و $t_{\frac{1}{2}}$ من الرصدة
($t_{\frac{1}{2}}$ يتم الحصول عليها من الرصدة و λ كسنها)

② . قم بوصل نفس الدائرة ولكن $R > 2000\Omega$ وقم بايجاد $t_{\frac{1}{2}}$ و λ بنفس الطريقة السابقة

③ . قم بوصل نفس الدائرة ولكن أزل R من الدائرة وقم بايجاد $t_{\frac{1}{2}}$ و λ
ثم احسب مقاومة الدائرة $(R)_{Circuit}$