

Exp 6: Capacitors and inductors

• Three circuits :-

1- first circuit :- RC-Circuit

V_c :-

$$\mathcal{E} - RI - \frac{q}{C} = 0$$

$$q(t) = C\mathcal{E}(1 - e^{-t/RC})$$

$$V_c(t) = \mathcal{E}(1 - e^{-t/RC})$$

$$\rightarrow V(0) = 0.63 \mathcal{E}$$

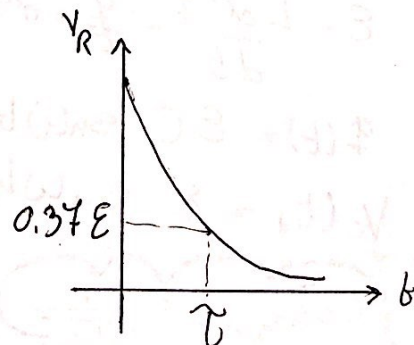
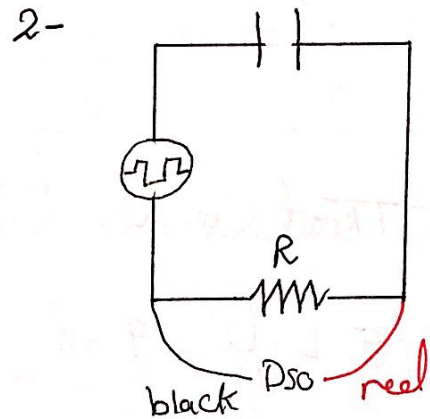
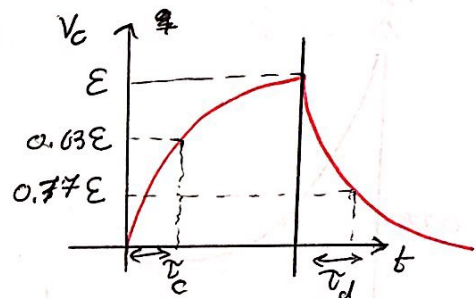
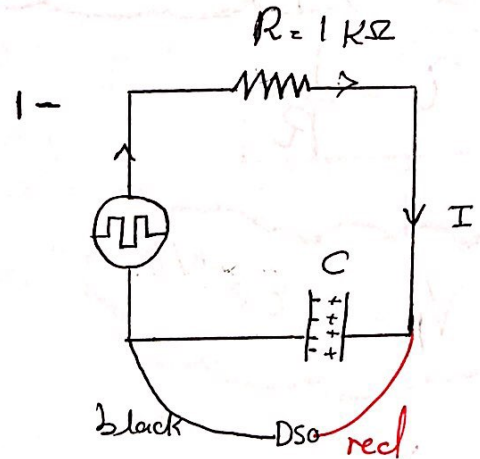
$$\tau_c = RC$$

$$V_c(t) = 0.37 \mathcal{E}$$

disch

$$V_R(t) = IR$$

$$V_R(t) = \mathcal{E} e^{-t/RC}$$



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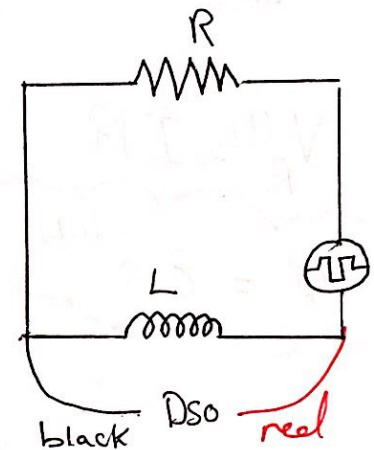
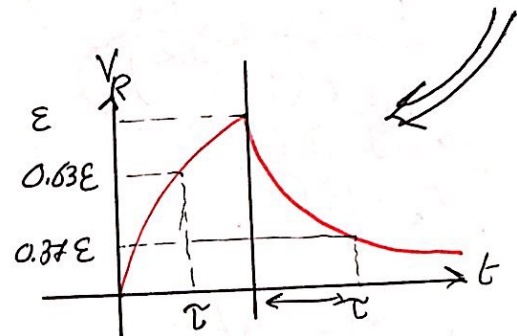
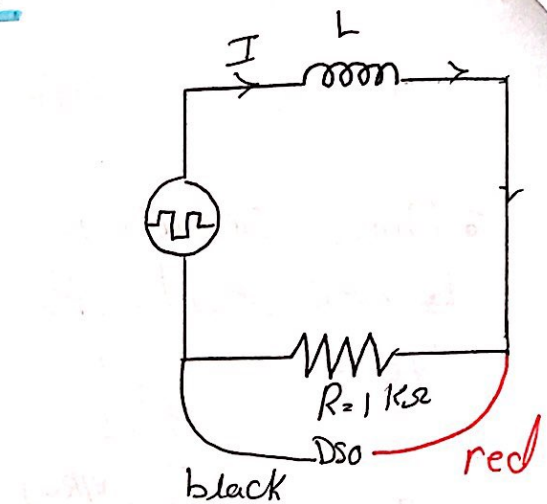
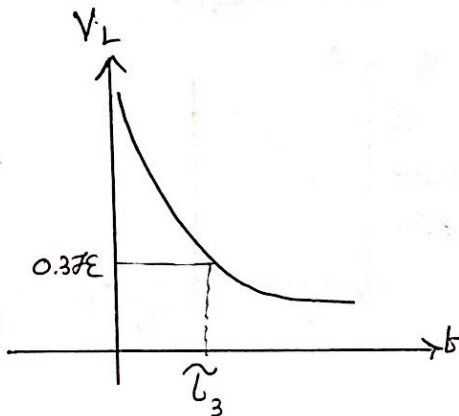
Second circuit: RL - Circuit

$$\mathcal{E} - L \frac{dI}{dt} - IR = 0$$

$$V(t) = \mathcal{E} (1 - e^{-Rt/L})$$

$$\tau = \frac{L}{R}$$

$$V_L = \mathcal{E} e^{-t/\tau}$$



Third Circuit: LC - Circuit

$$\mathcal{E} - L \frac{dI}{dt} - \frac{q}{C} = 0$$

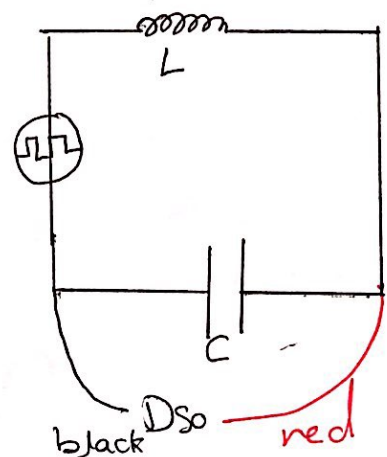
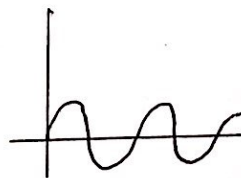
$$\mathcal{E} - L \frac{d^2q}{dt^2} - \frac{q}{C} = 0$$

$$q(t) = EC \sin(\omega t)$$

$$V_C(t) = \mathcal{E} \sin(\omega t)$$

$$\omega_{\text{theory}} = \frac{1}{\sqrt{LC}}$$

$$f = \frac{1}{2\pi\sqrt{LC}}$$



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لدينا ٢ دوائر :-

١- RC circuit

• What we use :-

- A Resistance
- A Capacitor
- An inductor
- signal Generator
- oscilloscope

• قم بوصل المواع مع جهاز DSO
• قم بوصل مولد الموجات مع المقادير

• يظهر لك رسمه charging & discharging على الشاشة (V_e)

• قم بحساب الثابت الزمني τ (τ_c , τ_d)

$\tau_{discharging}$ $\tau_{charging}$

• قم بحساب R و C حيث تضع R موصولة مع DSO و قم بحساب τ من رسمه V_R

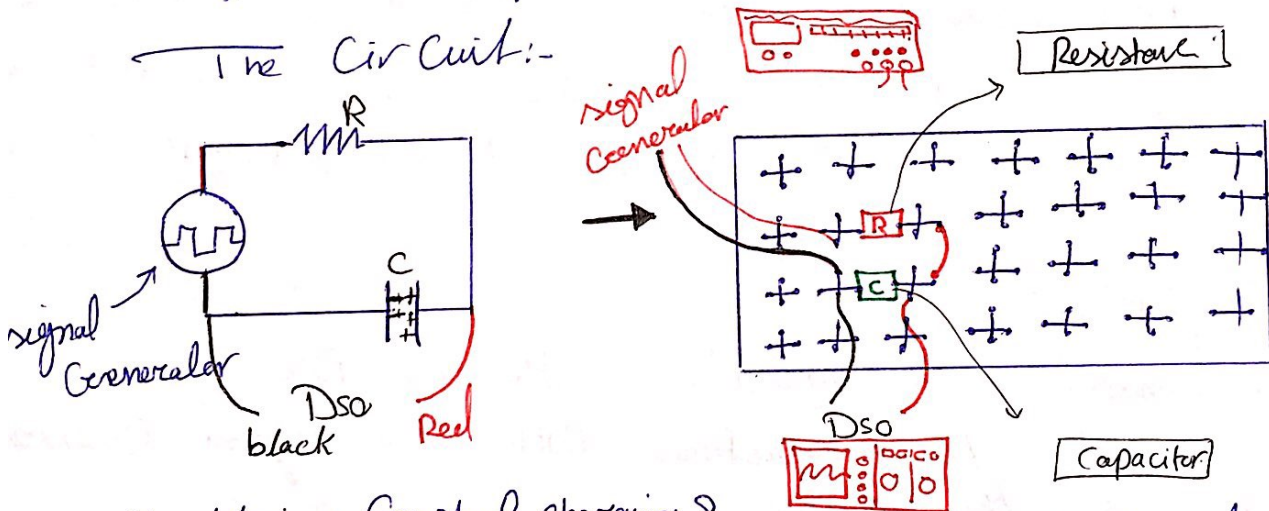
• Procedure :-

- We have three circuits to make :-

A-1- **R-C circuit** :-

- You connect the capacitor with the DSO (oscilloscope)
- You connect a signal Generator and a Resistance with the capacitor

The Circuit :-



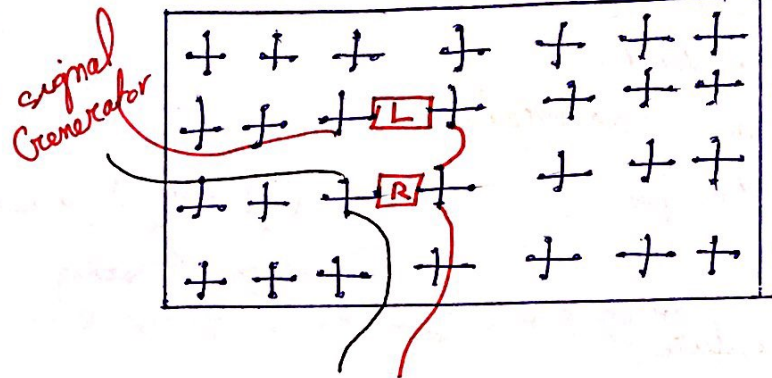
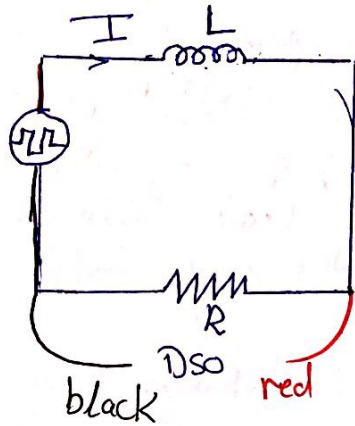
- You obtain a Graph of charging & discharging / you find $\tau_{1,2,exp}$ as I explained in Page
- 2- You connect R with the DSO and C with the signal Generator to obtain τ_3

B-1- **L-R circuit** :-

- You connect R with the DSO
- You connect L with signal Generator & R

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The Circuit :-



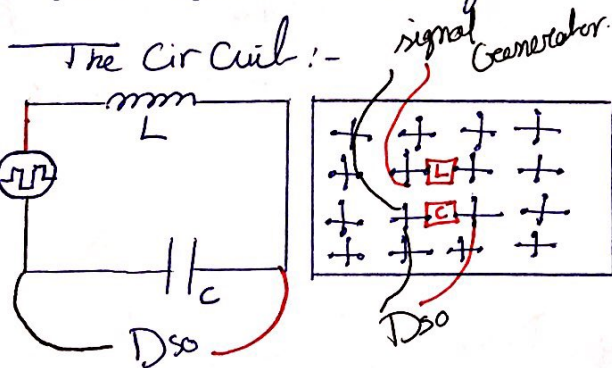
- You obtain the Graph of V_R ^{DSO}. Calculate V_C and V_L
- Replace R with L and obtain V_L to get V_3

L-R circuit.

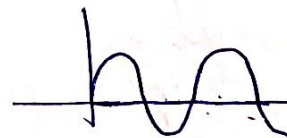
- 1- قم بوصل المقاومة مع جهاز DSO
- 2- قم بوصل الملف مع مولد الاشارات مع المقاومة في الشيفر
- 3- حصل على رسمه V_R على شاشة ال DSO وعيّنك V_C و V_L فيهما
- 4- تبديل R مع L و احصل على رسمه $V_L = V_3$

L-C Circuit:-

- You connect the Capacitor with the DSO
- You connect the Resistance with the signal Generator and with the Capacitor.



قم بوصل الدارة كما هو موضح
وعيّنك V_C على شاشة الجهاز



- obtain f_{exp} from the DSO
- By increasing f until Amplitude is maximized

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