Experiment 1:

breadboards have low frequencies less than 10 MHz.

DC power supply (constant voltage)
direct current

(+) high voltage terminal
(−) low voltage terminal.

* series and parallel resistors :- (theoretical).

- $R_{series} = R_1 + R_2 + R_n \cdots$, $R_{parallel} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_n} \cdots}$

- $V = V_1 + V_2 + \cdots$, $V = V_1 = V_2 = V_n$

- $I = I_1 = I_2 \cdots$, $I = I_1 + I_2 + I_3$

- $R = \frac{V}{I}$

- voltage division rule: (series) $V_{R_K} = \frac{V_s \times R_K}{R_{tot}}$ (series).

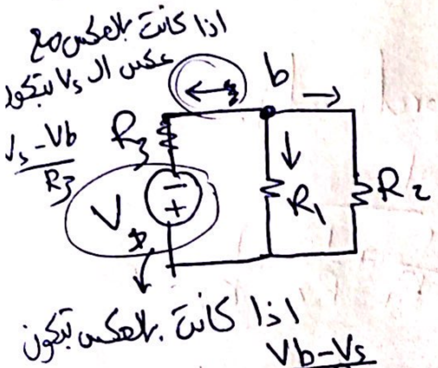
- current division rule: (parallel) $I_{R_K} = \frac{V_s}{R_K}$ (parallel)

· Experiment 2 :

inductors are considered "short circuits" in DC circuits

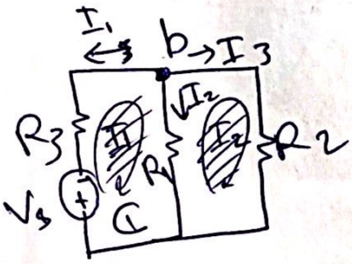
capacitors are considered "open circuits" in DC circuits.

Nodal analysis: KCL. أصباشام ال current source.



$$\frac{V_b + V_s}{R_3} + \frac{V_b}{R_1} + \frac{V_b}{R_2} = 0.$$

Mesh analysis: KVL أصباشام ال voltage source.



$$① \; -V_s \pm I_2 R_1 + I_1 R_1 + I_1 R_3 = 0.$$

deviation means: error

$$\frac{\text{theory} - \text{measured}}{\text{theory}} \times 100\%$$

DC Experiment 3:

Superposition:

If a circuit has more than one voltage / current source, we can calculate what each voltage/current source alone gives from I, V summing them up for each resistance.

$I_1 = I_S + I_D$ $V_1 = V_S + V_D$

However, power (p) does not abide by this.

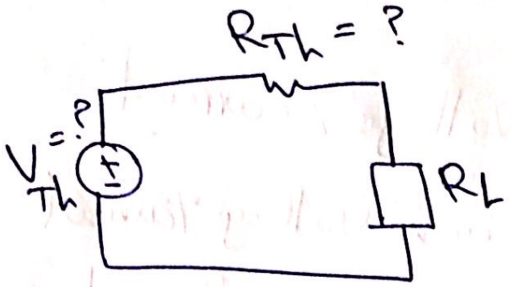
Thevenin-Norton:

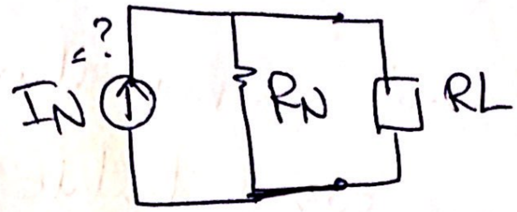
V_{Th} is measured by putting a voltmeter in an open circuit (instead of R_{Load}).

I_N is measured by putting a jumper in an ~~short~~ open circuit to make it short and putting an ammeter in this short circuit.

R_{Th} we kill all sources and put jumpers instead and we measure R_{tot} using ohmmeter from same spot as before.

R_{Th} is also $\frac{V_{Th}}{I_N}$

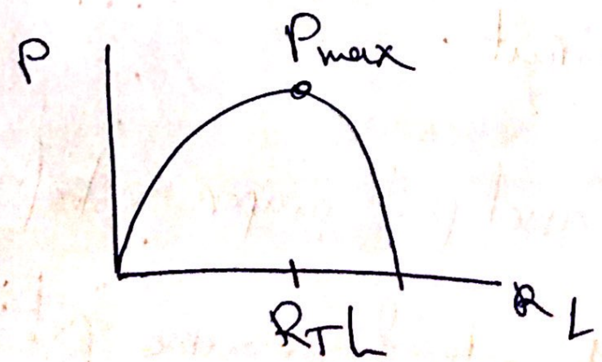




Max Power transfer: $P = \frac{V^2}{R}$.

max power is at R_{Th}

Use a potentiometer as a rheostat (a wiper and outer terminal) for changing the resistance and testing at what resistance is max power at R_L (the same spot), measure Voltage for this rheostat at a certain resistance and see power, it will be at R_{Th}.



Experiment 4 : Sinusoidal signals.

1) Amplitude: V_p (peak), maximum value in sinusoidal waveform (voltage level).

2) مصدر الاشارة داخل ال Function gen. وال Oscilliscope بس للعرض

3) V_{p-p} (peak to peak) voltage. From upper peak to lower (max to min) (مربعات)
and we read voltage depending on that (taking into consideration scaling) on oscilliscope.

4) to read frequency we read period (T) on oscilliscope, by عدد مربعات (division) x zoom (sec, μs, ms) (time/div) then $f = \frac{1}{T}$

5) $V_{p-p} = 2V_p$

$$V_{rms} = \frac{V_p}{\sqrt{2}}$$

6) cycles are periods.

$$V_s(t) = V_p \sin(\omega t) = V_p \sin(2\pi f t)$$

impedance of any component is in ohm.

ω is angular velocity.

if $V_p = 5$ then $V_{pp} = 10$.

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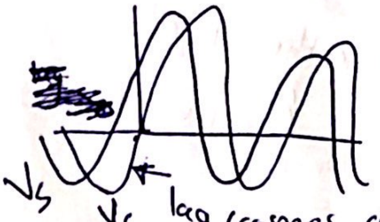
Experiment 5: Capacitive reactance.

① V_c with V_s lag

negative ∡



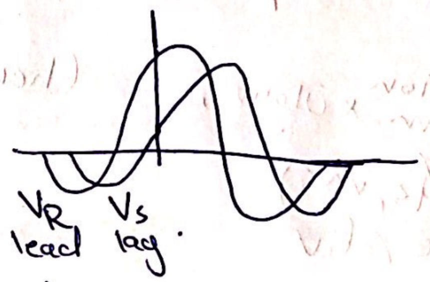
$$\measuredangle V_c \text{ with } V_s = \frac{\Delta(\text{div}) \times 360}{T(\text{div})} \quad (\text{negative})$$

Δ(div) : 2 waves عدد مربعات الفرق بين (او النقاط) (phase shift)

T(div) : عدد مربعات ال period

② To change $V_c \to V_R$ we change R and C places.

∡ V_R with V_s = same thing



$$I = \frac{V_R}{R}$$

or ∡I

Parallel
Part B is a different circuit but you are going to do this all over again, remember that AC circuits are SO much like DC and we used a small R to figure out $I_{tot} = \frac{V_R}{R}$ because we can't do that on Vs

③ X_c (reactance (like resistance)) → B لمعكوس susceptance.

$$X_c = \frac{|V_c|}{|I|}$$

Z (total impedance) → Y لمعكوس admittance.

$$Z = \frac{|V_s|}{|I|} \quad \text{or} \quad Z = R - j\frac{1}{\omega C}$$

$$\measuredangle Z = \measuredangle V_s - \measuredangle I \quad (\text{deg}^\circ)$$

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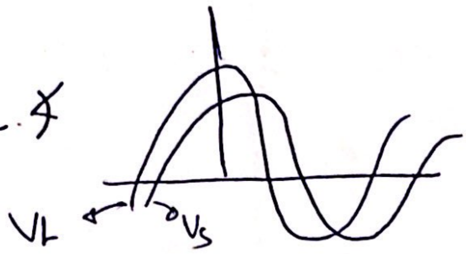
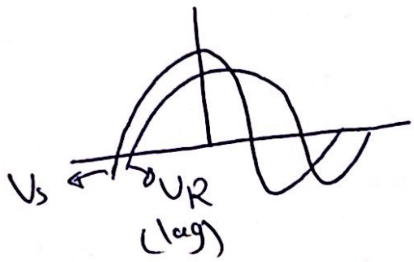
Experiment 6: Inductive reactance.

1. V_L with V_s lead — positive $\angle$



$\angle V_L$ with V_s = same thing.

2. $V_L \rightarrow V_R$



* remember that $V_{pp} = 2V_p$

$$I = \frac{V_R}{R}$$

3. $$X_L = \frac{|V_L|}{|I|}$$

$$Z = \frac{|V_s|}{|I|} \quad \text{or} \quad Z = R + j\omega L.$$

$$\angle Z = \angle V_s - \angle I$$

$$S = \frac{1}{2} V_p I_p \angle (\angle V - \angle I)$$
complex power

$$P = \frac{1}{2} V_p I_p \cos (\angle V - \angle I)$$
real power

$$Q = \frac{1}{2} V_p I_p \sin (\angle V - \angle I)$$
reactive power

$$PF = \cos (\angle V - \angle I)$$

Bonuses:

* For a series RC circuit I leads V_s.
* " " " RL " I lags V_s.

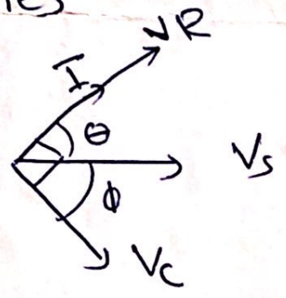
* admittance $Y = \frac{1}{Z}$ * $Y = I - V_s$.

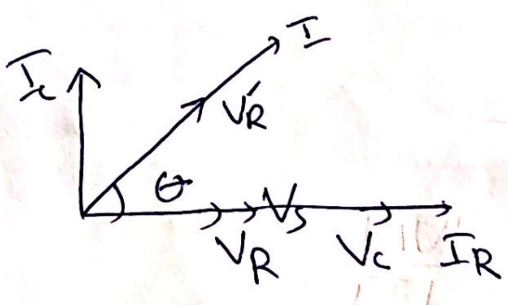
* $\omega = \frac{2\pi}{T}$ or $2\pi f$

* Phasor diagrams:

RC ~~RL~~

series parallel





RL

series parallel