Basic Elec. Engr. Lab

ECS 204/210

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Office Hours:
BKD 3601-7
Tuesday 9:30-10:30
Friday 14:00-16:00

Lab 5

- RC Circuit with Voltage Step Input
- Frequency Response of Series RLC Circuit
- AC vs DC modes of the Oscilloscope
- AC vs DC modes of the DMM
- Function generator: Offset

DMM: DC vs. AC

- V_{DC} = Average value

$$V_{DC} = \overline{v(t)} = \frac{1}{T}\int_{t_0}^{t_0+T} v(t)dt \qquad [V]$$

- V_{RMS} = RMS value

$$V_{RMS} = \sqrt{\overline{v^2(t)}} = \sqrt{\frac{1}{T}\int_{t_0}^{t_0+T} v^2(t)dt} \qquad [V_{rms}]$$

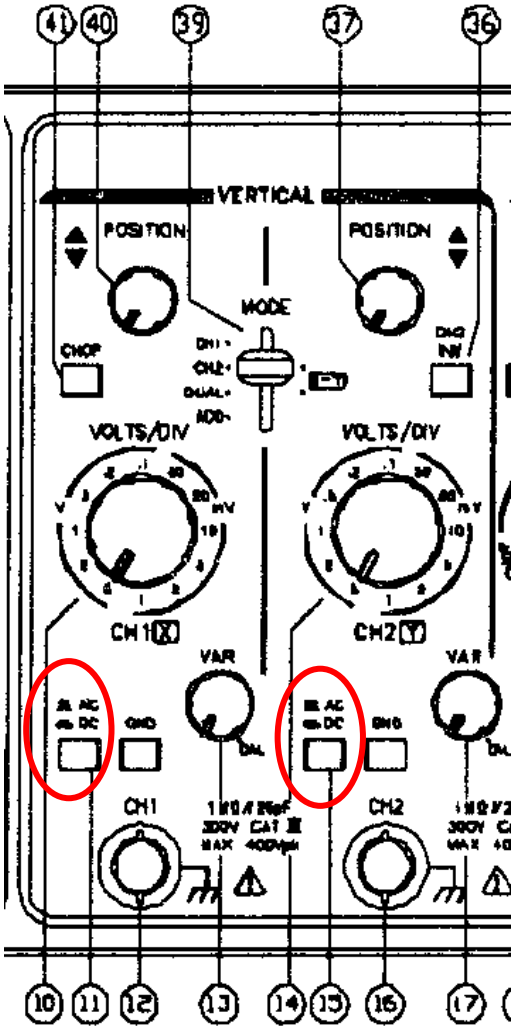
Equal when $V_{DC} = 0$.

- V_{AC}

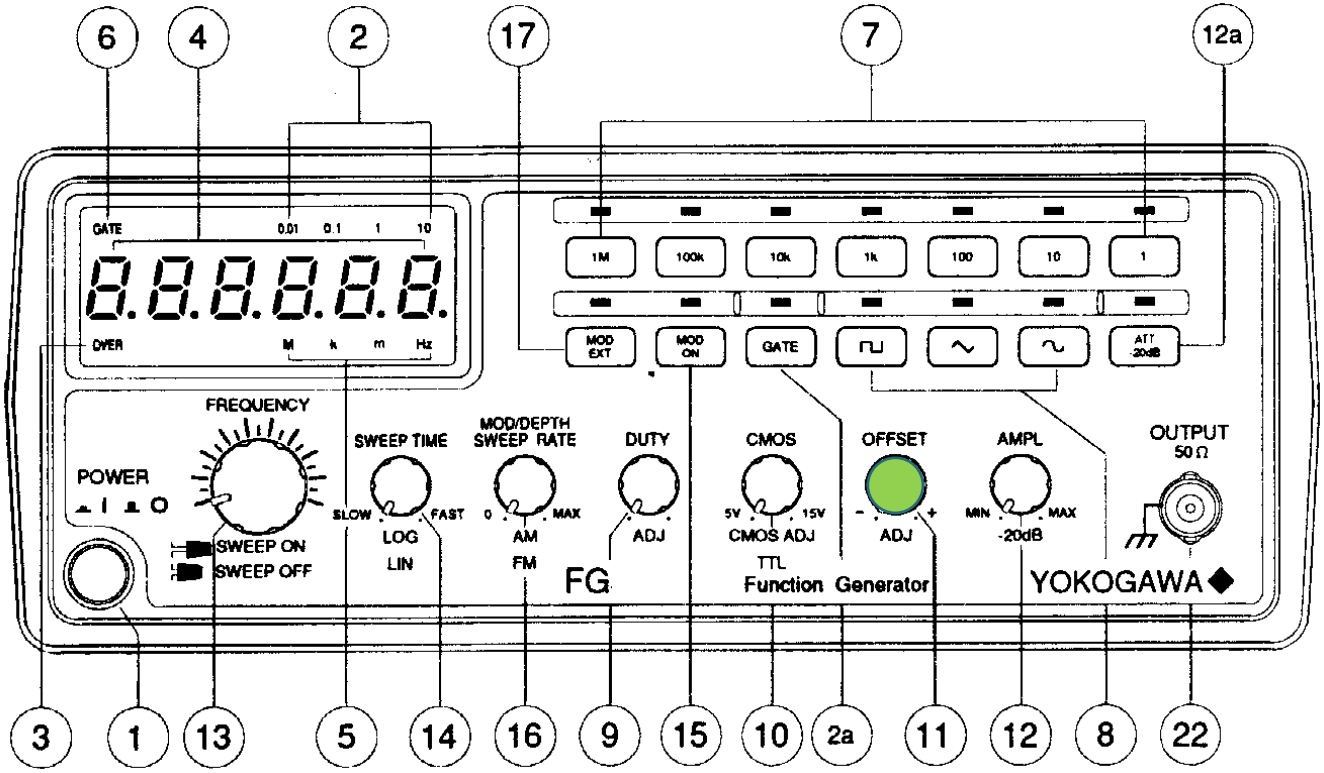
$$V_{AC} = \sqrt{\overline{\left(v(t) - V_{DC}\right)^2}} = \sqrt{V_{RMS}^2 - V_{DC}^2} \qquad [V]$$

Oscilloscope: DC vs. AC

- Input signal: $v(t)$
- DC mode: Show $v_{DC}(t) = v(t)$
- AC mode: Show $v_{AC}(t) = v(t) - \mathrm{V_{DC}}$
  - $v_{AC}(t)$ always have 0 average (theoretically.
- $v_{AC}(t) = v_{DC}(t)$ when $\mathrm{V_{DC}} = 0$.

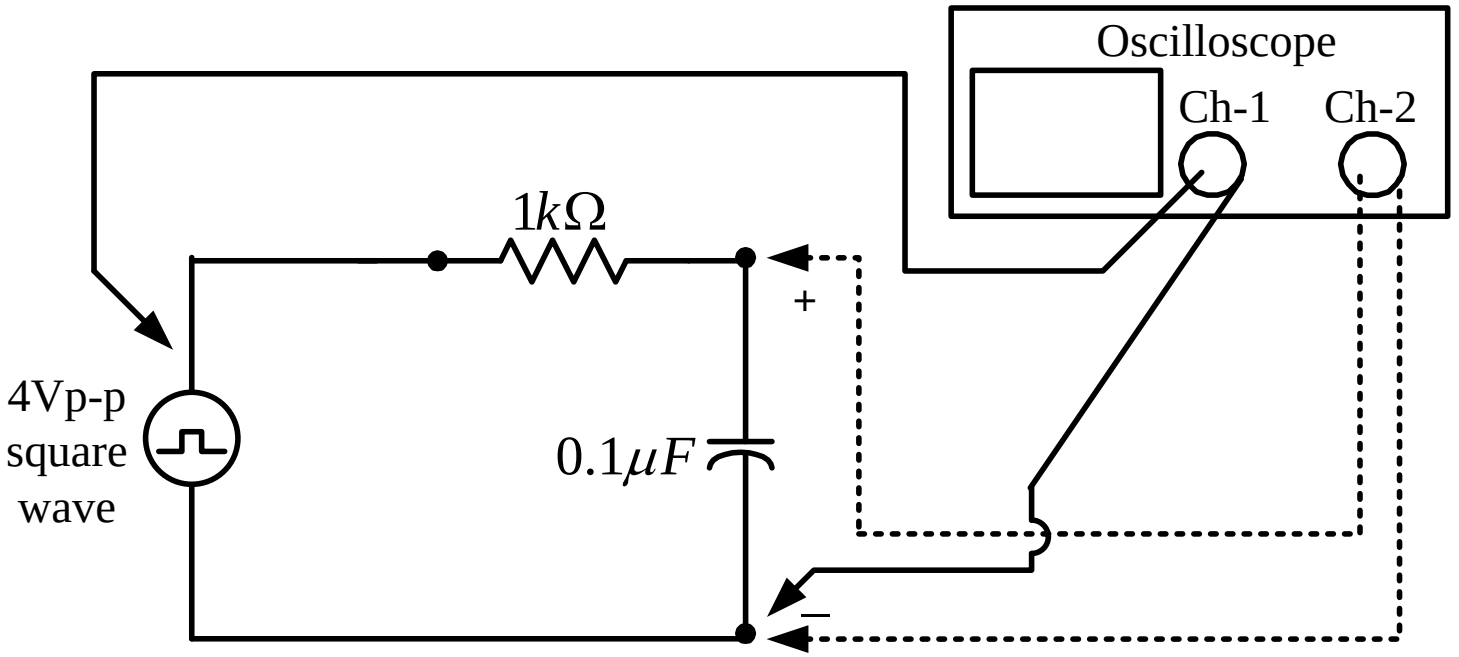


Function Generator: Offset



$$v_{out}(t) = v_{0\text{-offset}}(t) + \mathrm{V}_{\mathrm{Offset}}$$

Part A



Reading Capacitor Code

Code	Value
102	0.001 μF
103	0.01 μF
104	0.1 μF
473	0.047 μF
474	0.47 μF

$$47\times10^{4}\,\text{pF}=47\times10^{4}\times10^{-12}\,\text{F}=47\times10^{4}\times10^{-6}\times10^{-6}\,\text{F}$$

$$=47\times10^{4}\times10^{-6}\times10^{-6}\,\text{F}=47\times10^{-2}\,\mu\text{F}$$

$$=0.47\,\mu\text{F}$$

τ Measurement

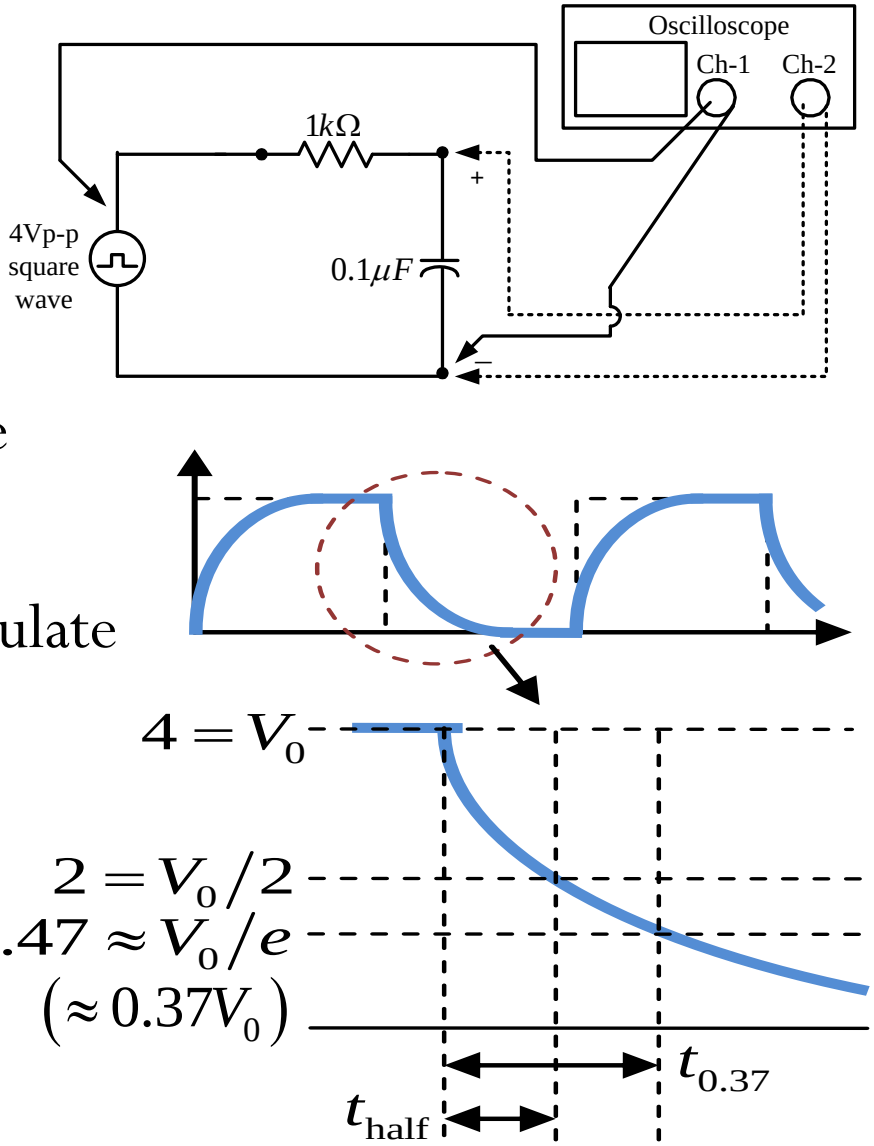
Three different methods:

- Measure $t_{0.37}$.
- Measure t_{half}. Then, calculate

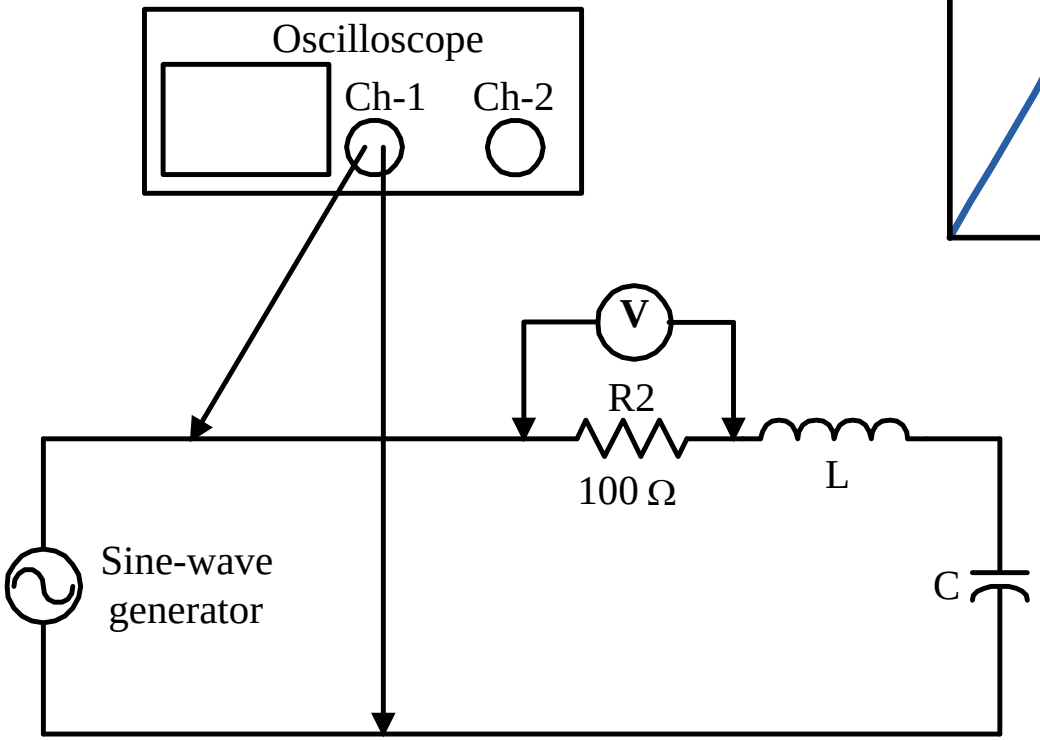
$$\tau = t_{\text{half}} / \ln 2$$

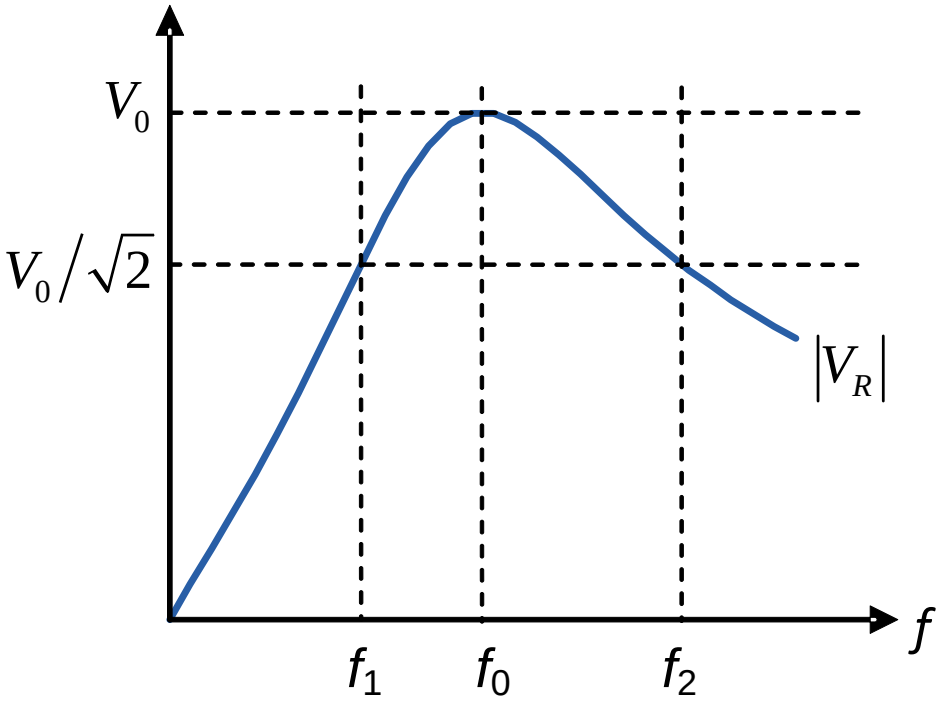
- Measure R and C. Then, calculate

$$\tau = RC.$$



Part B





$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

Midterm Results (20%)