Electronics Lab

This document contains two sample lab reports.

The instructions that were followed by the students have since been updated, so that your report may require a few different items.

1. Scanned image of a lab report for Lab #1.

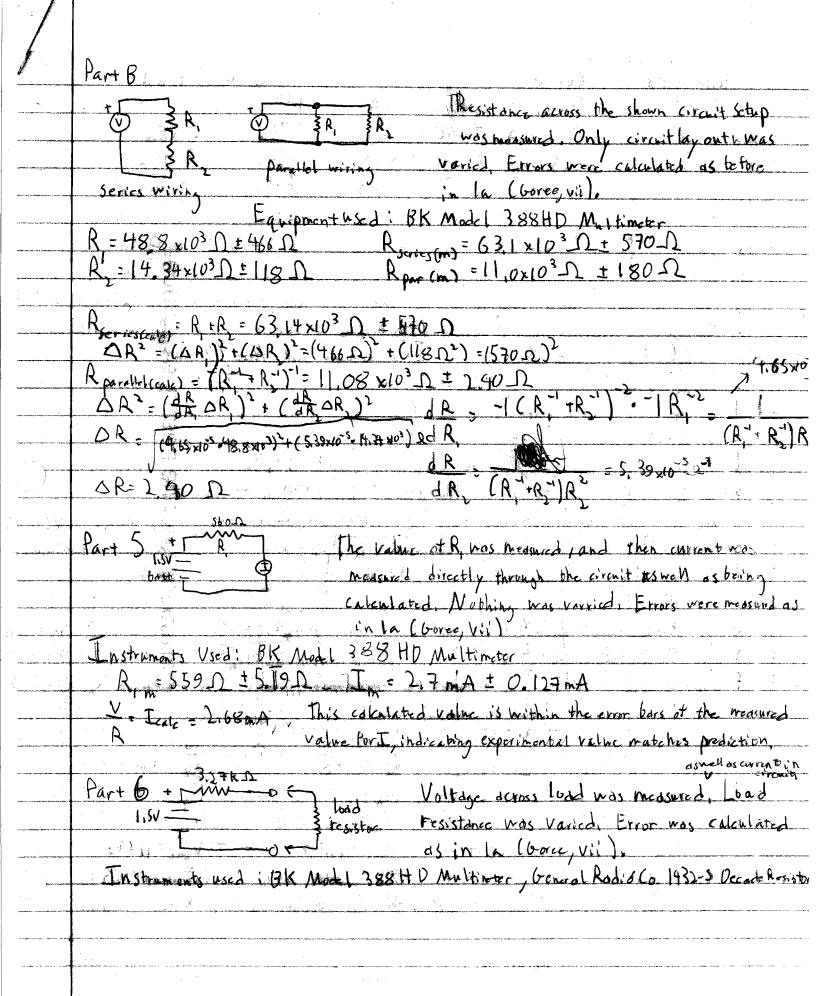
This paper was one of the best in the class in its year, although it is not as easy to read as the next example.

2. Scanned image of a lab report for Lab #2.

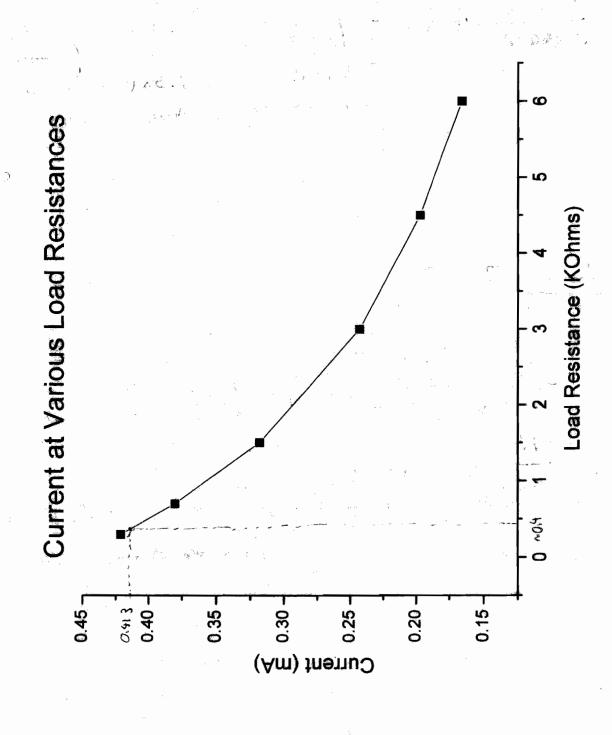
This is a perfect lab report for Lab #2. In addition to having perfect content, it is also very easy to read.

Laboratory Report 1 Preface: This report serves as a summary of the basic procedures the student carried out to familiarize himself with common electron; Laboratory equipment, simple circuits, error analysis, and basic circuit concepts, Section I, part A Drive noter multin I batteries In series former instruments used: BK Model 388-HD multimeter Voltage across the multimeter was measure. The pumber of batteries of their relative orientations were varied, Errors were estimated based on the specifications given in he law manual (Gares, Vi) Month = 1.565 V# 8.8 x10-3 V V = 3.11 V = 0,026 V V, == 0.047 V = 1.2x10-3 V Vecto 4 x10 3 V = 124x00-21 V Food = 3.12 6 V = 124 xW2V N + 1 + 1 > DN = (DN) + (= DN) + (= DN) = DN, DN, V - INTHAID IN The error ranges of Vingard Valle overlap, as do the error ranges of Viz - an-Vrente, indicating these experimental values agree with theoretical calculation: Part B Two Voltages productd DC measured Viltage putout by the power Supply was va Errors were estimated for bright La Corres, villfor me Supply and estimated at (1 V) Arthe eye for OC poner supply # 1 Instruments Used: BK model 388-HD multimeter +. 5 un HP721 A DC supply

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and Sypercy hand a service and and	The error bars for both V measurements overlap, as do those for the V; measurements, indicating that both measurements are resonable.											
	Part 2 RMS valtage output and frequency of the AC Source were measured. Nothing was varied. No errors supply were estimated.											
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<u> </u>		5%	19.34×10 ³	20K	±    8	0.00823						
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	0.7	380mA ± 0.004		£ 2,38mV
	1,5 0.	318nA + 0.00	The state of the s	± 3,46 mV
ge odove za vio <del>dov</del> vriogi	3	143nA + 0.00		£ 4,74mV
400000	4.5	197 mA + 0,00	297mA 906mV	± 5,53mV
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10000 Reg = 1 + 1 x10-3

Voint - Rolling - Vont = Roy Vin - 615-22-4.92V = 0.779V

9.779V ×100% = 47.790

4 This value is controlled the that the calculation + hardsmensey to reinforce one another.

2, Req = 1 = 766 1

Vond = Req Vin = 766 D - 4.96V = 1.57V

Rx+ Req (766 D + 1660 D)

3.34 V × 1007. = 47.0 70

This value is comprable to the experimental ratio, suggesting that the calct measurement reinfluese one

#### Electronics Lab

This is a sample lab report for Lab #2.

The instructions that were followed by the student here have since been updated, so that your report may require a few different items.

## Lab 2: AC Measurement



## Preface

- Measure AC signal (amplitude, frequency, phase) using oscilloscope
- · Study RC circuits

## Experiment

## 1. Measurement of Voltages

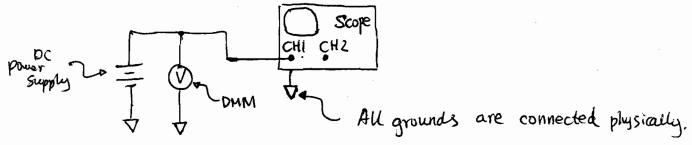
(a) DC voltage

Apparatus: oscilloscope, digital multimeter, power supply

Procedure: set up scope;

set output voltage of power supply;

measure the output voltage using the scope & the multimeter.



	Voltage set by power supply	voltage measured by multimeter	scale of multimeter	voltage measural by scope	scale c
	(1±0.25)V	(1.252±0.007)V	4 V	(1.25±0.05)V	0.51
	(2±0.25)V	(2.322±a.013)V	4V	(2,35±0.05)V	0.5V/Div
	(3±0.25)V	(3.260±0.017)V	4V	(3.30±0.05)V	0.5V/
,	Ralf the minimum scale, i.e. $\frac{1}{2}$ x0.5V	according to DMM's specification	mu	falf minimum division Uniplied by smale, i.e 0.1 div ×0.5 V/Div	۸

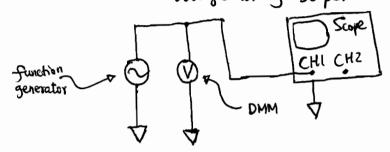
The meter is more precise than oscilloscope, although the precision of oscilloscope's measurement can be improved by choosing smaller scale for verticle display.

# (b) AC Voltages

Apparatus: oscilloscope, digital multimeter function generator

procedure: connect circuit;

set up function generator; measure RMS voltage using multimeter & peak-to-peak voltage using scope.



Results:

VRMS = 
$$(342.4 \pm 1.8)$$
 mV  $(8V) = 0.5\%$   
by DMM  
400 mV scale

Vpeak-to-park  $(1.00 \pm 0.02)$  V
by scope  $(0.2V)$  by  $(5V) = 2.9\%$ 

VAMS =  $(0.35 \pm 0.01)$  V  $(5V) = 2.9\%$ 

Calculated using Vpeak-to-peak

The meter is more precise, as seen from  $(\frac{\delta V}{V})_{\text{supe}} > (\frac{\delta V}{V})_{\text{pure}}$ 

# (e) AC & DC coupling

Difference:

in DC

to the rest
of scope

GND

using DC coupling, one can see a verticle deflection of the trace when changing the offset; For AC coupling, there is no response to DC offset.

When using AC coupling, the signal passes a capacitor, which blocks the DC offset.

# 2. Measurement of frequency

Apparatus: oscillosupe, digital multimeter, function generator

procedure: prepare the circuit as in 1(b) & (c);

measure frequency using multimeter;

measure time per cycle using scope & calculate frequency.

Frequency by uncertainty : In.

MM measurement

10.25 KHZ

0.13KHZ

by scope 10309Hz (using 1045/Div) uncertainty in scope measurement

103 Hz species

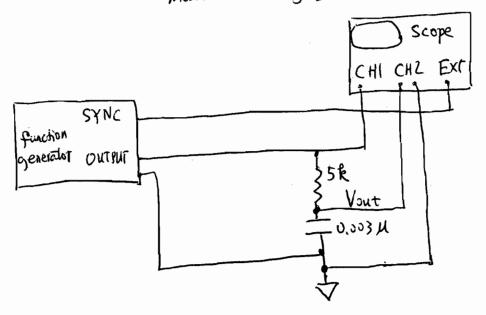
Lying  $|\frac{8f}{5}| = |\frac{8T}{T}|$ 1551= $|\frac{58T}{T}|$ 

# 3. Time constant of an R-c circuit

Appartus: Osillosuspe, digital multimeter, function generator, 5kp resistor, 0.003 UF capacitor

Procedure:

connect circuit
set function generator & the scope
measure charging & discharging times



Results:

$$R = 5.60 \, \text{k} \Omega \pm 0.04 \, \text{k} \Omega$$

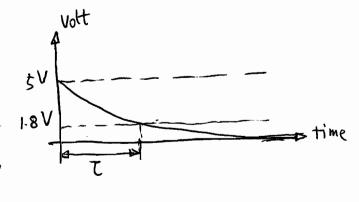
$$C = 3.50 \, \text{nF} \pm 0.11 \, \text{nF}$$

$$\text{Volt}$$
(a) Charging time
$$\frac{\text{change}}{\text{tmeasure}} = (2.0 \pm 0.1) \times 10^{10} \, \text{sV}$$

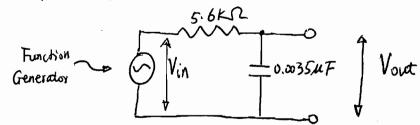
$$= 20.0 \, \text{Ms} \pm 1.0 \, \text{Ms}$$

$$\frac{\text{change}}{\text{tmeasure}} = 1.02$$





# 4. R-C Low-Pass Filter



Apparatus: same as

Procedure:

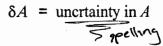
connect circuit as in 3 set function generator & supe measure Vout & Vin at various frequencies. measure time delay t between Vout & Vin.

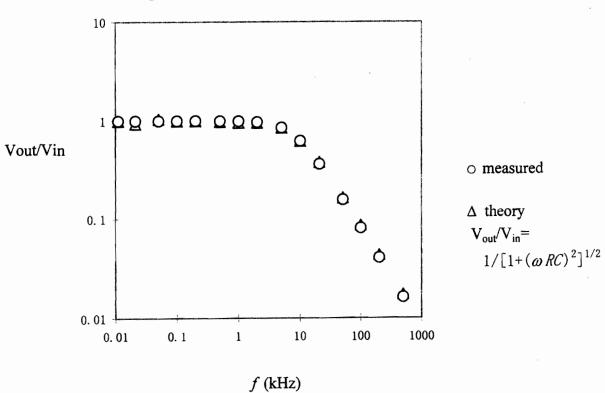
#### Results:

- (a) Amplitude response
  - (i) see next page.
  - (ii) see next page. (iii) The frequency at Void = a707 is

f measure = (8.32 ± 0.11) RHZ = 5 fmeasure = 1.02

R= C=		5. 60 3. 50	kΩ nF	± ±		. 04 .11	kΩ nF		
f (Hz)	δf		Vin	δVin	Vout		δVout	Vout/Vin (measure)	Vout/Vin (theory)
0.011	0.001		4.8	0.1	4.8		0.1	1.0	1.00
0.021	0.001		4.9	0.1	4.6		0.1	0.9	1.00
0.05	0.002		4.8	0. 1	5. 0		0.2	1.0	1.00
0.1	0.002		5.0	0.1	5. 0		0.2	1.0	1.00
0.201	0.003		5. 0	0. 1	5. 0		0.2	1.0	1.00
0.501	0.006		5. 1	0.1	5.0		0.2	1.0	1.00
1.001	0.011		5. 1	0.1	4.9		0.1	1.0	0.99
1.999	0.021		5. 1	0.1	4.9		0.1	1.0	0.97
5.02	0.06		5. 0	0.1	4.3		0.1	0.9	0.85
10.09	0.11		5. 1	0.1	3. 2		0.1	0.6	0.63
20.7	0.3		5. 1	0.1	1.95		0.02	0.4	0.37
50.8	0.6		5. 0	0.1	0.82		0.02	0. 2	0. 16
100. 1	1.1		5. 1	0.1	0.44		0.02	0. 1	0.08
200. 1	2. 1		5. 1	0. 1	0.22		0.01	0.0	0.04
500. 0	5. 1		5. 0	0. 1	0.086		0.002	0. 0	0. 02





Amplitude Response of A Low-Pass Filter

(b) Phase Response

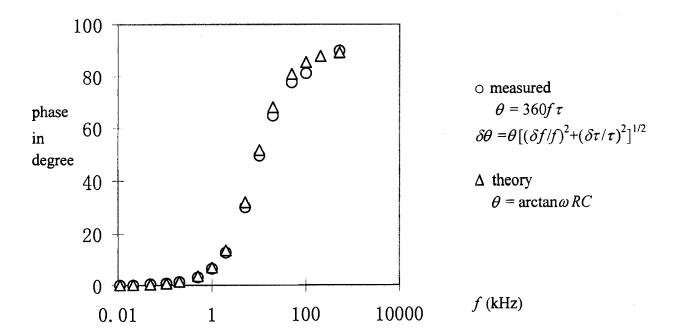
- (i) see next page
- (ii) see next page

(iii) The phase angle at 
$$f = \frac{1}{2\pi RC}$$
:

 $f = 8.1 \text{ kHz}$ 
 $\theta_{\text{measure}} = 43.15^{\circ} \pm 0.93^{\circ}$ 
 $\theta_{\text{theory}} = \arctan \text{ WRC}$ 
 $\theta_{\text{theory}} = \arctan \left(2\pi f \cdot RC\right)$ 

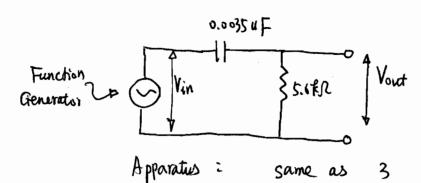
R=	5.60	$k\Omega$	<u>±</u>	$0.04 \text{ k}\Omega$
C=	3.50	nF	± ·	0.11 nF

f(kHz)	$\delta f (k  \text{Hz})$	delay in	$\delta  au$	phase in	$\delta  heta$	phase in
		$\operatorname{msec}\left(  au\right)$	msec	degrees $\theta$	degree	degrees
				(measure)	ŧ	(theory)
0.011	0.003	0.0000	0.0001	0.000	0.000	0.078
0.021	0.003	0.0000	0.0001	0.000	0.000	0.148
0.049	0.003	0.030	0.005	0.529	0.096	0.346
0.108	0.004	0.020	0.005	0.778	0. 197	0.762
0.204	0.005	0.018	0.002	1.322	0. 150	1.439
0.502	0.008	0.018	0.001	3. 253	0.188	3.538
1.001	0.013	0.0180	0.0005	6.486	0. 199	7.028
1.962	0.023	0.0180	0.0005	12.714	0.382	13. 584
5.08	0.08	0.0165	0.0005	30. 18	1.03	32.033
10.26	0. 13	0.0134	0.0002	49.49	0. 98	51.653
20.01	0. 23	0.0090	0.0002	64.83	1.62	67. 937
50. 1	0.8	0.0043	0.0001	77.6	2. 2	80.830
100. 1	1. 3	0.00225	0.00005	81.1	2. 1	85. 403
202.0	2. 3	0.00144	0.00002	104. 7	1.9	87. 741
509.0	5. 4	0.00049	0.00001	89.8	2. 1	89. 131



Phase Response of A Low-Pass Filter

# 5. R-C High-Pass Fitter



Procedure:

connect circuit as above; set function generator & scope measure Vout & Vin at various frequencies

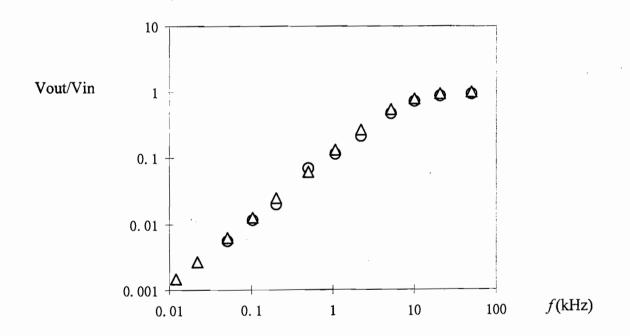
## Resutts.

- (i) See data table in the next page;
- (ii) Amplitude response in the next page.

R=	5.60	$\mathbf{k}\Omega$	±	$0.04~\mathrm{k}\Omega$
C=	3.50	nF	±	0.11 <b>nF</b>

f (kHz)	δf	Vin	δVin	Vout	δVout	Vout/Vin (measure)	Vout/Vin (theory)
0. 012 0. 022 0. 051 0. 103 0. 201 0. 498 1. 065 2. 207 5. 16 10. 03 20. 65 50. 1	0. 003 0. 003 0. 004 0. 004 0. 005 0. 008 0. 014 0. 025 0. 08 0. 13 0. 24 0. 6	5. 0 5. 0 5. 0 4. 9 5. 0 4. 8 4. 9 5. 0 5. 0 4. 9 5. 0 5. 0	0. 1 0. 1	0. 000 0. 000 0. 028 0. 057 0. 100 0. 333 0. 559 1. 05 2. 33 3. 5 4. 3 4. 6	0. 001 0. 001 0. 001 0. 001 0. 002 0. 005 0. 02 0. 02 0. 1 0. 1	0. 0 0. 0 0. 0 0. 0 0. 0 0. 1 0. 1 0. 2 0. 5 0. 7 0. 9	0. 00 0. 00 0. 01 0. 01 0. 02 0. 06 0. 13 0. 26 0. 54 0. 78 0. 93 0. 99

 $\delta A = \text{uncrtainty in } A;$ 



o measured

 $\Delta$  theory Vout/Vin =  $\omega RC/[1+(\omega RC)^2]^{1/2}$ 

High-Pass filter