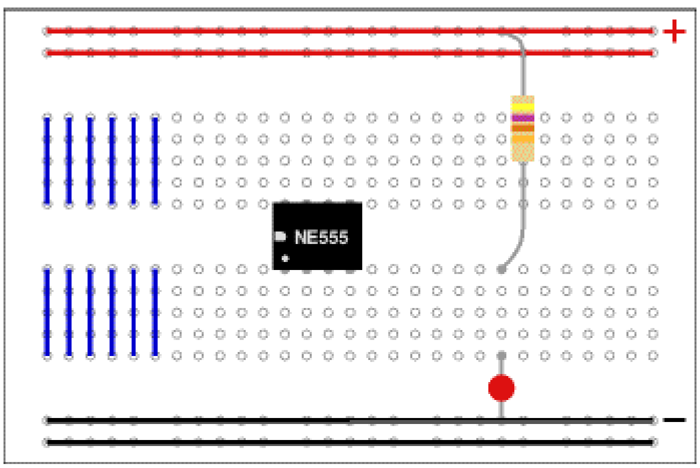
UNIVERSITY OF TECHNOLOGY, JAMAICA

SCHOOL OF ENGENEERING

Electrical Engineering Science

Laboratory Manual



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Experiment #1 OHM'S LAW

STUDENT NAME……………………… COURSE NO……………………
TEAMMATE…………………………… MARKS…………………………
LECTURER'S SIGNATURE…………... DATE……………………………

Introduction

A dc power supply, ammeter, and decade resistance box are connected in series. A voltmeter is connected to monitor the resistor voltage. The voltage, resistance and current are set to the outlined. The measured quantities should confirm Ohm's law.

To further demonstrate Ohm's law, the resistance and voltage are independently adjusted and the current level is measured.

Equipment

DC Power Supply – (0 to 25V, 100 mA)
DC Ammeter – (100 mA)
Electronic Voltmeter – (30V)
Decade resistance box – (0 to 10KΩ, 100 mA)

Procedures

1. Check that the power supply is switched off and that its output is set for zero voltage.

2. Set the resistance box to 100Ω and connect the equipment as shown in diagram, Fig 1.

3. Switch on the power supply and adjust it to give E = 10 V.

4. Record the current level, (use the Record Sheet included with this experiment), and compare the measured current to the calculated value.

5. Alter R to 250Ω and adjust the voltage until the ammeter indicates I =100mA.

6. Record the new level of E, and compare the measured voltage to the voltage calculated.

7. Adjust the power supply to give E = 25 V, and alter the decade box until I = 30mA.

8. Record the calculated and measured values of R.
9. Adjust the decade box to double the value of R. Record the corresponding values of R, E and I. Note how the current is affected when R is doubled.

10. Adjust the decade box until R is half the resistance used in procedure 8. Record the corresponding values of R, E and I. Note how the current is affected when R is halved.

11. Reset R to 200 Ω and E to 10V. Record R, E and I.

12. Adjust the power supply to double the value E to 20 V. Record the new values of R, E and I and note how **I** is affected when E is halved.

13. Adjust the power supply to E= 5V, (halved the voltage level used in procedure 11). Record the level of I, and note how I is affected when E is halved.

14. Adjust the power supply to give E = 0 V, and reset R to 250 Ω .

15. Adjust the power supply output to increase E in 5 V steps from 0 V to 25 V. At each step record the levels of E and I indicated on the instruments.

16. Switch off the power supply, and dismantle the circuit.

Table 1

Procedure #		
4	R = 100 Ω E = 10 V	Calculated I Measured I
6	R = 250 Ω I = 100 mA	Measured Voltage “E” = Calculated V =
8	E = 25 V I = 30 mA	Measure R = Calculated R
9	R doubled	R = E = I = Effect on current?
10	R halved	R = E = I = Effect on current ?
11		R = E = I = Effect on current ?
12	E doubled	R= E = I = Effect on current ?

Procedure #		
13	E halved	R = E = I = Effect on current ?
15	R = 250 Ω	E (Volts) I (mA) 5………………… 10………………… 15………………… 20…………………. 25………………….

Analysis 1 – (Ohm’s Law)

2-1 From the results of procedures 3 through 6, calculate the power dissipated in R in each case.

2.2 For procedures 7 through 10, calculate the power dissipated in R in each case. Discuss the effects upon power when R is doubled and halved.

2.3 For procedures 11 through 13 calculate the power dissipated in R in each case. Discuss the effects upon power when E is doubled and halved, and when I is doubled and halved.

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Experiment # 2 SERIES AND PARALLEL CIRCUITS

STUDENT NAME……………………… COURSE NO………………
TEAMMATE…………………………… MARKS…………………
LECTURER'S SIGNATURE……….…………… DATE……………

OJECTIVE: To investigate the properties of series and parallel resistive circuit and to determine the internal resistance of a 1.5V cell.

APPARATUS:
D.C. Power Supply
Bread Board
Digital Multimeter
R1-20KΩ Carbon Resistor
R2-33KΩ Carbon Resistor
R3-100Ω Carbon Resistor

PROCEDURE:

<u>Activity #1</u>

1. Connect the circuit as shown in figure 1, have it checked and approved by the lecturer / technician.

Figure 1

2. Open the circuit at point A and use the multimeter to measure the current. Record this value in table 1.

3. Repeat procedure in step 2 for points B and C.

4. Measure and record the voltage across each of the resistors R1 and R2.

5. Measure and record the total voltage across R1 and R2.

6. Use the Ohmmeter to measure the total resistance of the circuit and record this value (**make sure the power is disconnected before performing this step.**)

Results For Activity 1

Point	A	B	C
Current I, (A)			

What can you say about the current at each point of the circuit?

____
____
____

Are the resistors connected in series or parallel? ____________________________

Voltage across R1 ________________ Voltage across R2 _______________

Total Voltage across R1 and R2 _________________

Measured total resistance of R1 and R2 ________________

Calculate the total resistance of R1 and R2.

Is the total resistance you measured consistent with the calculated value?

____

Activity #2

7. Connect the circuit as shown in figure 2, have it checked and approved by the lecturer / technician.

Figure 2

8. Open the circuit at point A and use the multimeter to measure the current. Record this value in table 2.

9. Repeat procedure in step 8 for points B and C.

10. Measure and record the voltage across each of the resistors R1 and R2.

11. Use the Ohmmeter to measure the total resistance of the circuit and record this value (**make sure the power is disconnected before performing this step.**).

RESULTS FOR ACTIVITY # 2

Activity #2

Point	A	B	C
Current I, (A)			

Voltage across R1 ____________ Voltage across R2 _____________

What can you say about the sum of the individual voltages with respect to the total voltage?

____

____

____

____

Measured total resistance of R1 and R2 ________________

Calculate the total resistance of R1 and R2. Is the total resistance you measured consistent with the calculated value?

____
____
____

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Experiment # 3 MEASURING POTENTIAL DIFFERENCE AND CURRENT IN SERIES-PARALLEL CIRCUITS

STUDENT NAME……………………… COURSE NO……………………
TEAMMATE…………………………… MARKS…………………………
LECTURER'S SIGNATURE…………... DATE……………………………

Objective: To learn how to use and analyse series-parallel connections of resistors.

Apparatus:

Resistors, 1/4W, 1K, 3.3K, (2)-10K, (2)-5K (OHM)
Power supply 10V D.C.
VOM

Introduction:
In many electronic circuits, series-parallel connections are used. These experiments deal with the analysis of a series-parallel connection, by measurement of the current flowing through the circuit, and the voltage across the circuit.

<u>Circuit Diagram</u>

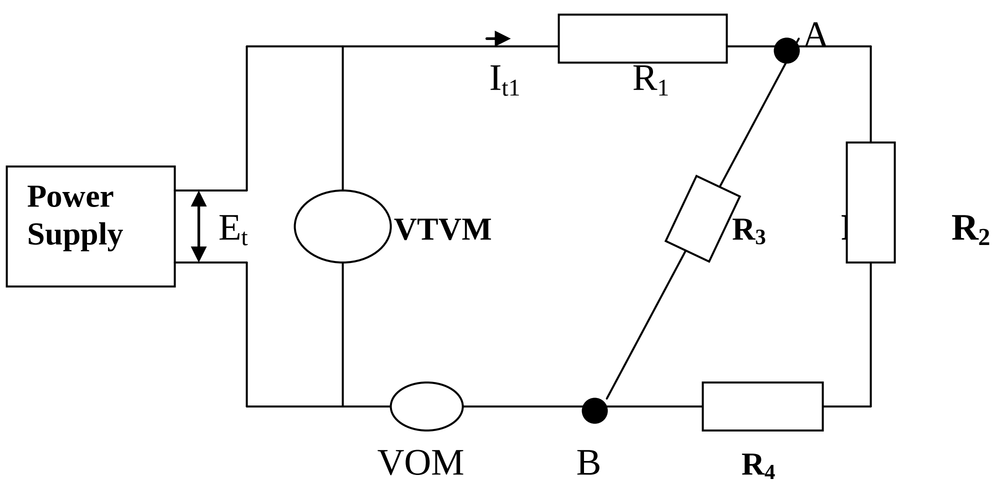

Fig. 1

Wire a circuit according to diagram of Fig. 1. Have the technologist or technician check and approve circuit connection before switching on the power supply.

3.2 Calculate the total current I_{t1} in the circuit

I_{t1} = ____________________

Measure the current I_{tl}

I_{t1} = _____________________

Question 1

Is it possible to use the meter on the power supply for the measurement of E_t?
Yes / No
If there is no good reason, in your opinion, for using the VTM instead of
the power supply-meter, then in your own words. State why you have made this choice.

____
____
____

Now measure E_t,

E_{t1} = ______________

3.3 Change to the circuit in Fig. 2. (The VOM changes place)

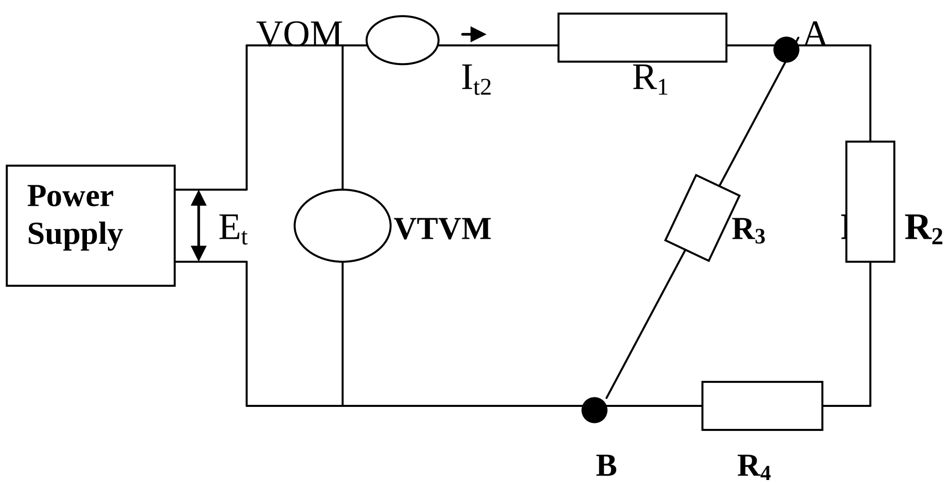

Figure 2

Measure I_{t2}

I_{t2} = ________________

If I_{t2} is equal to I_{t1} in section 3.2, explain why.

___

___

___

3.4 We shall now examine the effects of disconnecting a series resistor.

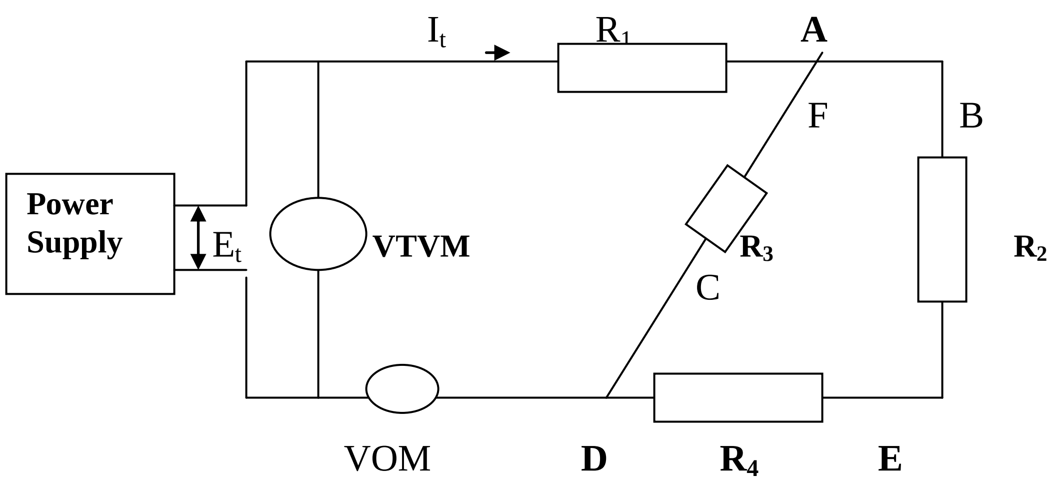

Figure 3

Disconnect R_1 at point A.
Draw below a single equivalent diagram of this circuit, leaving out any branch without current.

Calculate I_t I_{t3} = ______________________________

Calculate E_t E_{t3} = ___________________________________

Now measure I_t and E_t . I_{t3} = _______________ E_{t3} = ___________________

3.5 Examination of the effects of disconnecting a parallel branch.

Refer to the circuit diagram of Fig. 3
Re-connect R1 at point A
Disconnect R2 at point B
Draw the equivalent circuit below:

Calculate I_t and E_t I_{t4} = _______________ E_{t4} = _______________

Measure I_t and E_t I_{t4} = _______________ E_{t4} = _______________

3.6 Change the circuit to the one in Fig.4 (VOM changes place)

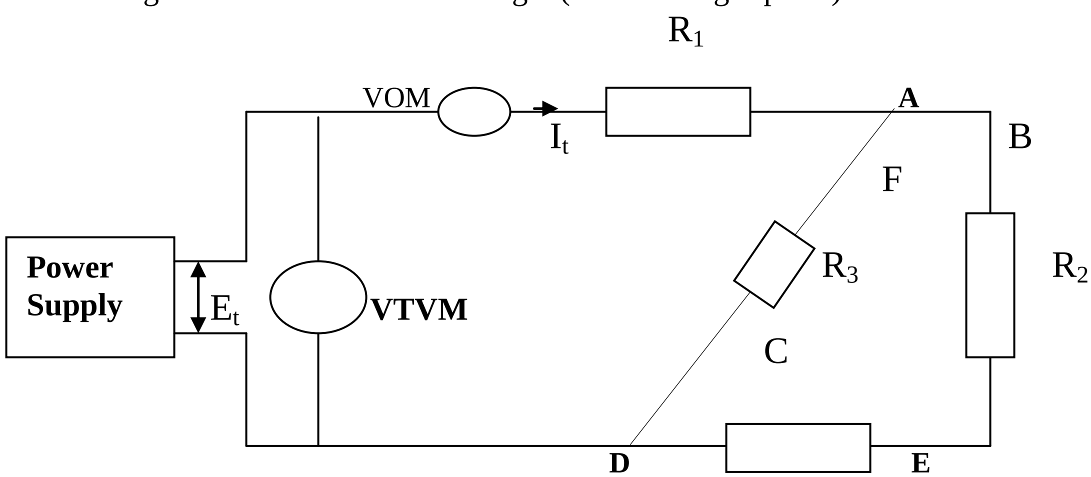

Figure 4

Now again disconnect R2 at point B and measure I_t and E_t

I_{t5} = ______________ E_{t5} = ______________

If I_{t5} equals I_{t4} (section 3.5), then explain why:

____
____
____
____

3.7 We shall examine the effects of disconnecting an alternative parallel branch.

Refer to fig. 3

Reconnect R2 at point B.

Disconnect R3 at point C

Draw below the equivalent circuit, leaving out all branches, without current flow.

Calculate I_t and E_t in this circuit:

I_{t6} = _________________ E_{t6} = _________________

Measure I_t and E_t

I_{t6} = _________________ E_{t6} = _________________

Explain possible discrepancies between your calculations and measurements.

____
____
____
____

3.8. We shall now examine the effects of short-circuiting one of the series resistors in the parallel branch.

Refer to fig. 3.

Reconnect R3 at point C.

Short circuit R4 by connecting a wire between points D and E.

Draw the equivalent circuit for this configuration below.

Calculate I_t and E_t

I_{t7} = ______________ E_{t7} = __________________

Measure I_t and E_t

I_{t7} = ______________ E_{t7} = _____________

3.9 We shall now examine the effects of short-circuiting the single resistor parallel branch.

Refer to fig. 3

Remove the wire between points D and E.

Short-circuit R3 by connecting a wire between F and C.

Draw the equivalent circuit below leaving out any branch without current.

Calculate I_t and E_t

I_{t8} = ______________ E_{t8} = ______________

Measure I_t and E_t

I_{t8} = ______________ E_{t8} = ______________

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Experiment # 4 **CATHODE RAY OSCILLOSCOPE**

STUDENT NAME……………………… COURSE NO……………………
TEAMMATE…………………………… MARKS…………………………
LECTURER'S SIGNATURE………….. **DATE……………………………**

OBJECTIVE:
At the end of this exercise, students should know the operation and the use of oscilloscope to display and measure voltage amplitudes and frequencies.

APPARATUS

- Oscilloscope
- Signal Generator

PROCEDURES

Activity 1

a) Turn on the oscilloscope and adjust the necessary controls to establish a clear bright, horizontal line across the center of the screen.
b) Connect the signal generator to the vertical input (V or Y-input) of the oscilloscope and set the output of the generator to a 100Hz waveform.
c) Set the volts/div setting of the oscilloscope to 1V/div and adjust the amplitude control of the signal generator to establish a 4V peak-to-peak sinusoidal waveform on the screen.
d) Set the time/div setting of the scope to 0.1ms/div (or 100μs/div). Observe the waveform and calculate the time period and frequency.
e) Change the time/div setting of the scope to 1ms/div. Observe the waveform and calculate the time period and the frequency.

Question 1: i) Did the frequency you calculated in parts (d) and (e) change significantly? ________________________

ii) What did you observe about the height and the width of one cycle of the sinusoidal waveform as the time/div setting changed from 0.1ms/div to 1ms/div? ____
____
____
____

Give reasons for your observations.? ____________________________________
____
____

Activity 2

a) Do not touch the controls of the signal generator but return the time /div setting of the scope 0.1ms/div.
b) Change the volts /div setting of the scope to 2V/div. Observe the waveform and calculate the peak-to-peak value of the sinusoidal waveform on the screen.

c) Change the volts/div setting of the scope to 0.5V/div. Observe the waveform and calculate the peak-to-peak value of the sinusoidal waveform on the screen.

Question 2: i) Did the voltage values you calculated in parts (b) and (c) change significantly? ____

ii) What did you observe about the height and the width of one cycle of the sinusoidal waveform as the volts/div setting changed from 2V/div to 0.5V/div? ____
____
____
____

Give reasons for your observations.? ____________________________________
____
____
____
____

Activity 3

a) Make all the necessary adjustments to clearly display a 5,000Hz 6V pp sinusoidal signal on the oscilloscope in the center of the screen.
b) Draw the waveform on figure 1, carefully noting the required number of

horizontal and vertical divisions. Record your chosen volts/div and time/div settings.

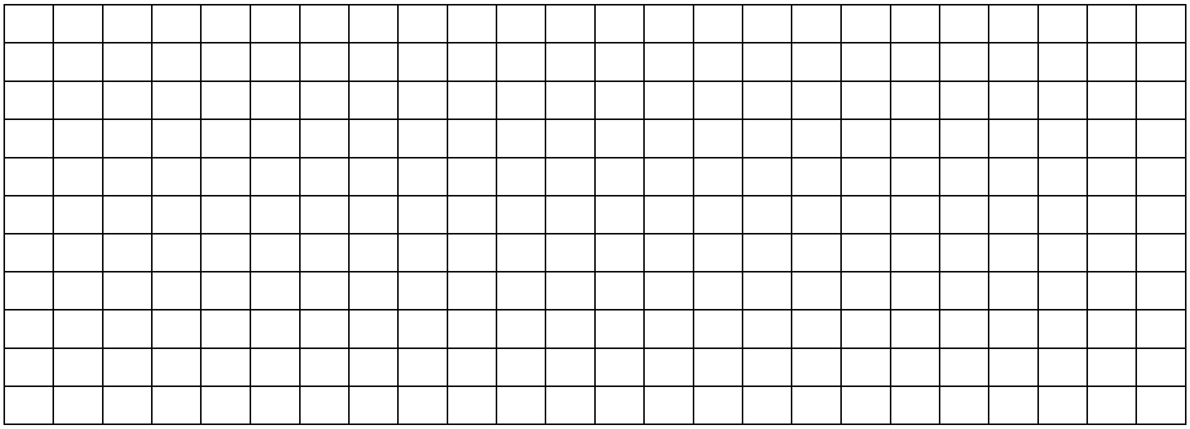

Fig. 1 - Graph for Waveform

Volts/div = _________

Time/div = _________

<u>Calculations and Observations</u>

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LAB # 5: RC Time Constant

NAME:______________________

GROUP:____________________

OBJECTIVE To investigate the time constant of a RC circuit.

APPARATUS
Digital Multimeter (DMM)
Timer/Stop watch
R1 - 560KΩ Resistors
C1 - 33µF Capacitor
C2 - unknown Capacitor

Activity #1 : Charging a capacitor through a resistor

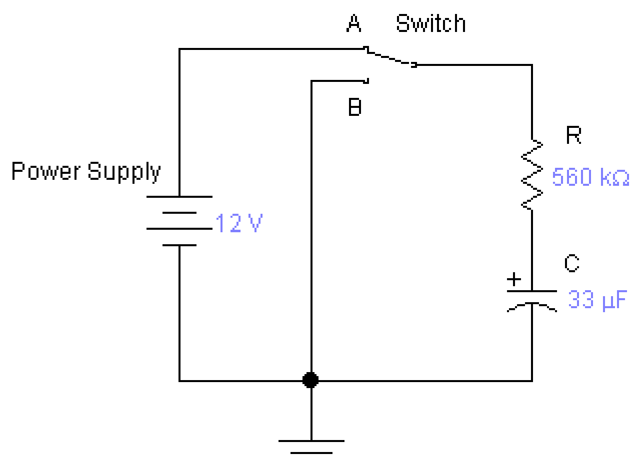

Figure 1.

1. Set up the circuit as shown in figure 1 with the switch in position A. (**NOTE THE POLARITY OF CAPACITOR IN THE CIRCUIT**)
   Have your circuit checked before turning on the power supply!

2. Place a piece of wire across the capacitor and turn on the power supply. The wire across the capacitor keeps the capacitor voltage at zero.

   This step requires two persons, one to operate the stopwatch and one to take readings. The person with the stopwatch will indicate to the other when to take readings from the voltmeter and the other person should be watching the voltmeter to record the voltage at the instances indicated by the person *with the timer*.

3. Set the stopwatch to 00:00. Simultaneously remove one end of the wire and start the stopwatch. Record the voltage at the time intervals shown in table 1. **Do not stop the timer until this process is completed.**

Time (s)	5	10	15	20	25	30	35	40	45	50
Voltage (V)										

Time (s)	55	60	65	70	75	80	85	90	95	100
Voltage (V)										

Table 1.

4. Use the values in table 1 to plot a neat graph of voltage versus time.

<u>Activity #2</u>: Discharging a capacitor through a resistor

1. With the switch still in position A, briefly place the piece of wire across the terminals of the resistor (**the wire should be removed from the circuit**). This is done to make sure the capacitor is fully charged. At this point the voltage across the capacitor should be about 12V.

2. Reset the stopwatch. With the same two person partnership, remove the wire and then quickly place the switch in position B and start the stopwatch. Record the voltage across the capacitor at the time intervals in table 2.

Time (s)	5	10	15	20	25	30	35	40	45	50
Voltage (V)										

Time (s)	55	60	65	70	75	80	85	90	95	100
Voltage (V)										

Table 2

3. Use the values in table 2 to plot on the **same graph sheet**, the graph of voltage versus time.

Activity #3: Using the time constant to determine the value of an unknown capacitor.

1. Place the unknown capacitor in parallel with the one already in the circuit and repeat procedures of activity 2 and record your values in table 3. Use the values in table 3 to plot on the **same graph sheet**, the graph of voltage versus time.

Time (s)	5	10	15	20	25	30	35	40	45	50
Voltage (V)										

Time (s)	55	60	65	70	75	80	85	90	95	100
Voltage (V)										

Table 3

Questions

(Show all working)

1. Calculate the theoretical value of the time constant, τ for the circuit of figure 1. Given that $\tau = RC$.

____

____

____

2. The time constant τ is the time the RC circuit takes to **charge** to 63% of the supply voltage or to **discharge** to 37% of the supply voltage. Determine from both the charge and discharge graph the time constant of the circuit of figure 1.

63% of the supply voltage =____________ 37% of the supply voltage =____________

Time constant (charging), τ_c = ____

Time constant (discharging), τ_d = ____

Compare the theoretical and actual values of the time constant.

3. Examine the two discharging curves, which of the two has the larger time constant? Give reason/s for your answer.

4. Determine from the discharge curve of the paralleled capacitors RC circuit, the value of the unknown capacitor. **Show all working.**

5. If a resistor was placed in series with the one in figure 1, how would this affect the time constant? Give reason/s.

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SCHOOL OF ENGINEERING
ELECTRICAL PROGRAMME

Experiment # 6 **CHARACTERISTICS OF A SERIES RLC CIRCUIT**

LAB. SHEET NO……………………………….. GROUP……………………………….

NAME…………………………………………… DATE……………………………………

I.D. No…………………………………….

LECTURER'S SIGNATURE:…………………………………

1. Objectives:

1. 1 To verify that the impedance Z of a series RLC circuit is

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

1. 2 To determine how the impedance of a series RLC circuit varies with frequency.

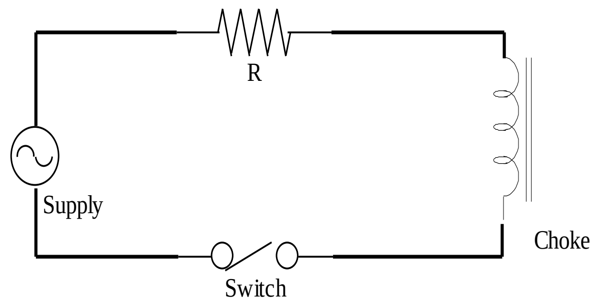
(Non-experimental notes on the characteristics of a series resonant circuit – Annex.)

2. **Apparatus**

6.3V 50Hz power supply
VTVM
Oscilloscope
Audio frequency signal generator: (NATIONAL VP – 702B or similar)
Resistor: 1/2 W 5000 ohms
Capacitor: 0.1F, 0.05F
Switch: SPST
Choke: 8H at 50mA dc.
Linear decimal graph paper

3. **Procedures 1** Verification of $Z = \sqrt{R^2 + (X_L - X_C)^2}$

3.1



3.2 Wire circuit 1 as shown in step 3. Then 6.3V RMS supply will give about 18V p-p (6.3 x 2.82). Measure this value of E with a VTVM and record in Table 1.

3.3 Measure the voltage V_R across R and V_L across L and record in Table 1.

3.4 Compute the current I_1 in the circuit and record in Table 1.
Use the rated values of R and measured value of V_R to determine I_1.
Compute and record also the impedance Z of the circuit using

$$Z = E / I$$

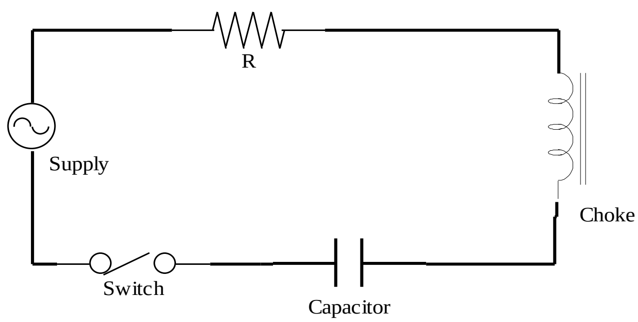
Show your computations on page 8.

3.5 Table 1

E= App Volts	V_R (Volts)	V_L (Volts)	I_1 (Amps)	Z = (Ohms)

3.6 Connect a 0.1 F capacitor in series with R and L as shown in circuit 2.

3.7 Circuit 2



3.8 Measure the applied voltage E, and the potential differences V_R, V_L and V_c across R, L and C respectively, using the VTVM.
Record your results in Table 2.

Table 2

E	V_R	V_L	V_C	I_2	X_C	X_L	$E= \sqrt{R^2 + (X_L - X_C)^2}$

3.9 Using the measured values of $V_{R,}$ and the rated value of R, compute the current I_2. Also compute the values of X_L and X_C from the computed value I_2 and the measured values of V_L and V_C.
Record the results in Table 2. Show your computations.

3.10 Compute and record the impedance Z of the RLC circuit of circuit 2, using the formula:

$$Z = E / I_2$$

Show your computations:

3.11 Compute and record Z using the formula:

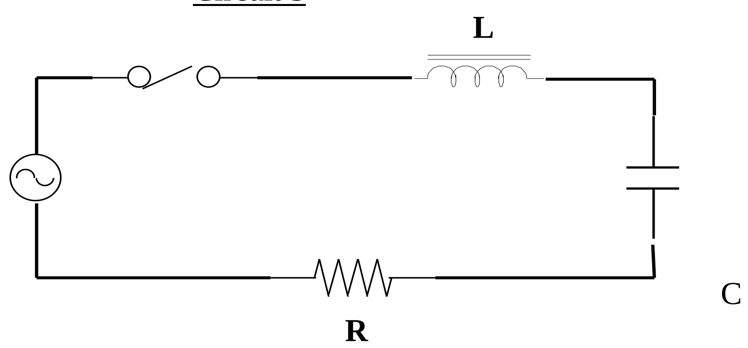
$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

Use the values of X_L and X_C form table 2.

Show your computations

Procedures 2 **Effect of Frequency on Impedance**

Circuit 3



4.1 Disconnect circuit 2 from the power supply and insert the 0.05F capacitor in series with L and R as shown in circuit 3. Do not connect to the signal generator until the Lecturer or Lab Technician has approved the circuit.

4.2 When circuit 3 has been checked set the signal generator at about three-quarters of the maximum voltage and a frequency of 150Hz.

4.3 With a VTVM connected across R and an Oscilloscope calibrated to measure peak to peak volts connected across A.N. (i.e. across L and C in series), increase or decrease the frequency of the signal generator as required, until the voltage V_{AB} is minimum. At this point, the voltage V_R across R should be at a maximum.

4.4 Note the frequency $\mathbf{F_R}$ at which there is a minimum $\mathbf{V_{AB}}$ and record in table 3. Measure and record the applied voltage **E**, the voltage $\mathbf{V_R}$, $\mathbf{V_L}$, $\mathbf{V_C}$ and $\mathbf{V_{AB}}$.
Use the oscilloscope to measure all voltages expect V_R but remember that they are peak to peak and you must calibrate the RMS values before recording them in table 3.

4.5 Compute and record the difference between V_L and V_C. Also compute and record the current I using $I = V_R / R$ and the impedance $Z = E / I$ applied.
Show your computations here:

4.6 Decrease the frequency of the generator by 20Hz and record the new frequency, F_R -20. Set the output E of the generator at the same level as for F_R in the step 4.4. Repeat the measurements and computations of step 4.4 at the frequency F_R-20 and record in Table 3.

4.7 Repeat step 4.6 for each frequencies shown in Table 3. Be certain that, for each frequency, the output of the generator is kept at the same voltage level as in step 4.4.

4.8 From the data in Table 3 draw a graph of:

4.8.1 Z versus F
4.8.2 I versus F

4.10 Table 3

Frequency Hz	Applied Volts (E) P-P rms	V_R (volts) P-P rms	V_L (volts) P-P rms	V_C (volts) P-P rms	V_{AB} (volts) P-P rms	V_L-V_C (volts)	I (Amps)	Z (Ohms)
F_R -100 =								
F_R -80 =								
F_R -60 =								
F_R -20 =								
F_R =								
F_R +20 =								
F_R +40 =								
F_R +60 =								
F_R +80 =								
F_R +100 =								

Questions

5.1 Refer to your data in Table 1 and 2. How was the impedance of the circuit 1 affected by adding a capacitor C, as in circuit 2? **Answer here:**

5.2 i) State the condition for which the current I will be a maximum, and impedance Z a minimum in circuit 2.

ii) What is the technical term given for this condition in (i) above.

5.3 Compute the value of maximum current.

5.4 What is the value of minimum impedance?

5.5 How does the experimental value of Z in step 3.10 compare with the formula value in step 3.11? Explain any difference.

5.6 Refer to your data in table 3 and to the graph of Z versus F. Explain, in your own words the effect on Z for a change in F.

5.7 Refer to your data in table 3 and to the graph of I versus F. Explain in your words the effect on I for a change in F.

5.8 In circuit 2 what should be the effect on Z, if any, by interchanging L and C? Why?

5.9 In table 3, comment on the relationship, if any between the measured voltage V_{AB} and the voltage $V_L - V_{C,}$ (or $V_C - V_L$), at any specific frequency. Explain any unexplained results.

5.10 Assume that the external resistor R, in circuit 2 short-circuited. What will limit the value of current I, when $X_L = X_C$

ANNEX (PAGE 1)
NOTES ON THE CHARACTERISTICS OF A SERIES RESONANT CIRCUIT

General

In the Lab experiments just completed; you examined how the impedance of the series RLC circuit varied with frequency. At one particular frequency, referred to as **RESONANT FREQUENCY (F_R)**, you should have concluded that the impedance of the circuit attained a minimum value equal to the resistance of the circuit. Indeed at resonance the circuit behaves just like a pure resistance. Since the impedance is minimum then the circuit current, I, must be of course maximum. (Your graphs should confirm these last two statements).

We know from the general impedance formula of $Z = \sqrt{R^2 + (X_L - X_C)^2}$.
Therefore Z = R
Hence Z = R and I = E / Z = E / R

Note that the current at resonance is limited only by the resistance of the circuit, even though it still possesses inductance and capacitance. In the absence of a resistor, the limiting resistance will equal to the inherent resistances of the inductor, capacitor and associated wiring. It is the latter resistances which prevent the current in practical series resonant greatest, and it is R_L (the resistance of the Inductor "L") which mainly controls the current at resonance in a series circuit which does not contain any resistors.

Voltage Amplification

The quality, **Q**, of a series resonant **CL** circuit is given by the formula:

$$Q = X_L / R_L$$

It should not be forgotten that at resonance, although the p.d. or voltage drop across the series capacitance – inductance combination is zero, the p.d. across each is in fact, a maximum.
(It is because the two voltages are in opposite phase that their joint new voltage is zero).

Now the voltage across L, $V_L = I*X_L$, but at resonance $I = E/R_L$ and if we substitute this in the formula we get.

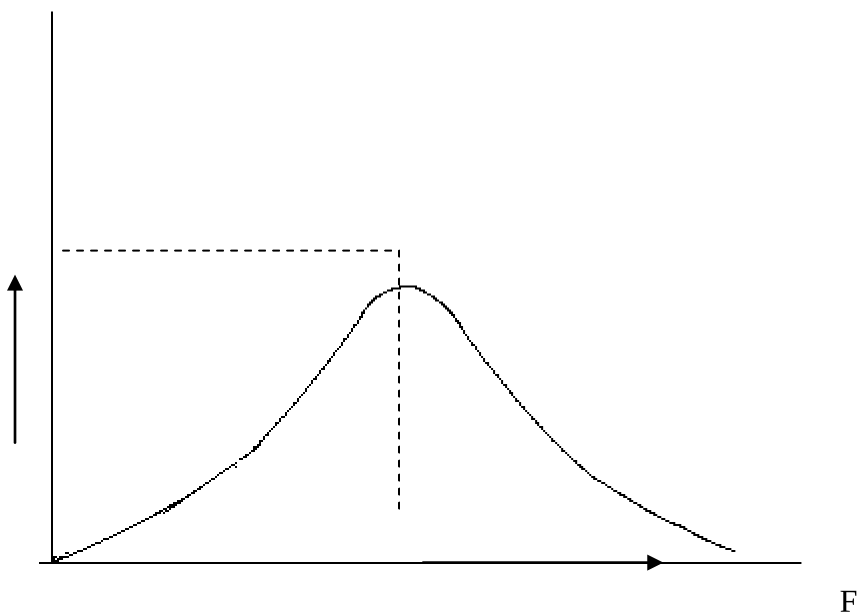
$$V_L = (E*X_L)/R_L$$

But $Q = X_L/R_L$, hence $V_L = QE$

Frequency Response Characteristics

More important to people in the radio field is the effect of Q on the frequency response characteristic. (You drew these from your experimental data).
Your I versus F graph will look something like this:

Graph 1



This point I and F are very important to radio designers and they are referred to as the **HALF POWER POINTS.** The reason for this is beyond the scope of this but suffice it to say both points occur when the current is 70.7 percent of its maximum value. (I max occurs when $F = F_R$.

UNIVERSITY OF TECHNOLOGY
JAMAICA

Electrical Engineering Science

LAB # 7: RECTIFICATION AND SMOOTHING

NAME:______________________

GROUP:____________________

OBJECTIVE To investigate diode testing, rectification and smoothing circuits.

APPARATUS
Oscilloscope
Digital Multimeter (DMM)
Signal Generator
4 -Silicon Diodes, 1N4001
1- Germanium Diode
3.3KΩ Resistors
10μF Capacitor
100μF Capacitor

THEORY Most modern digital multimeter (DMM) can be used to determine the condition of the diode, that is, whether it is good or bad. They have a scale that denoted by a diode symbol that will indicate the condition of the diode in the forward and reverse bias regions. If connected to establish a forward and reverse bias connection, the meter will display the forward bias threshold voltage while in the reverse bias condition, an "OL" or "1" may appear on the display to indicate the open circuit approximation. The threshold voltage for silicon is 0.7V while that for germanium is 0.3V.

Activity #1 Diode Test

1. Choose a silicon and germanium diode.

2. Using the connection shown in figure 4.1 check each diode using the diode testing scale on the DMM. Record your results in table 4.1.

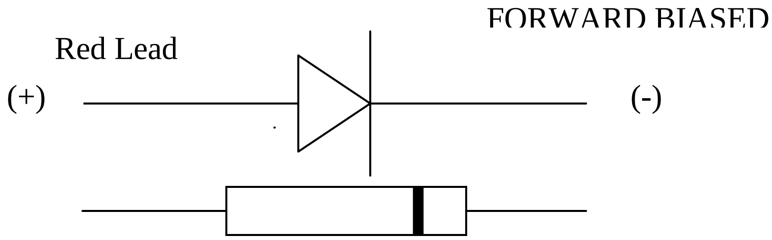


Figure 4.1

TEST	SILICON	GERMANIUM
FORWARD		
REVERSE		

Table 4.1

From the results you have obtained in 1. and 2., what can you say about the work condition of each diode?

____

<u>Activity #2</u> **Half-Wave Rectifier**

1. Construct the circuit of figure 4.1. Obtain your input signal V_{in} from the output of the transformer provided.
2.

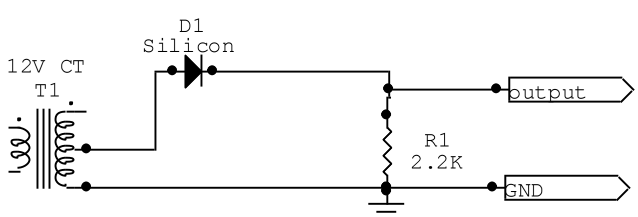


Figure 4.1

3. On the graphs of figure 4.2a and 4.2b sketch the input voltage, V_{in} and the output voltage V_{out} respectively. Also note the vertical and horizontal sensitivity.

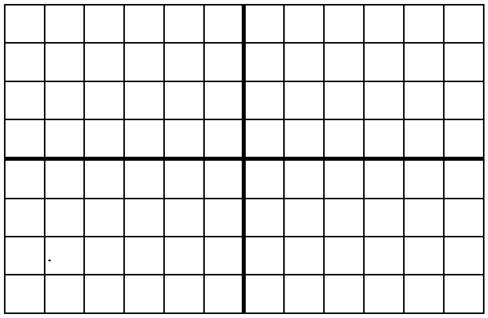


Figure 4.2a

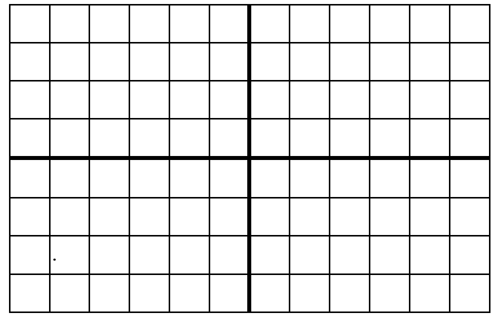


Figure 4.2b

Vertical sensitivity = __________

Horizontal sensitivity = ________

Vertical sensitivity = _________

Horizontal sensitivity = ________

Activity #3 Full - Wave Bridge Rectification And Smoothing.

4. Construct the circuit of figure 4.3. Obtain your input signal V_{in} from the output of the transformer provided.

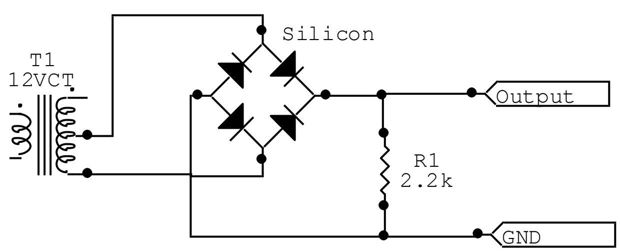


Figure 4.3

2. On the two separate graphs of figure 4.3 sketch the input voltage, V_{in} and the output voltage V_{out}. Also note the vertical and horizontal sensitivity.

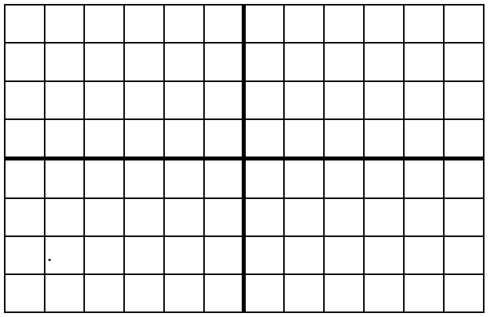


Figure 4.4a

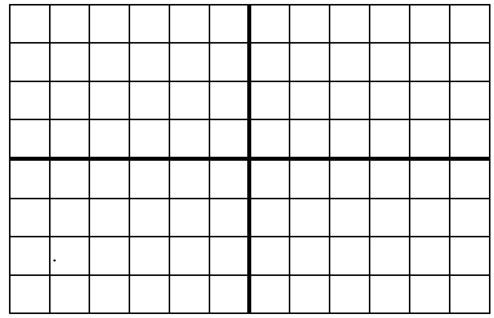


Figure 4.4b

Vertical sensitivity = __________

Horizontal sensitivity = ________

Vertical sensitivity = __________

Horizontal sensitivity = ________

3. Connect the given capacitor across the output, one at a time. Use the oscilloscope to observe the voltage at the output and make sketches on figure 4.4 to show the effect of each capacitor when it is placed in the circuit.

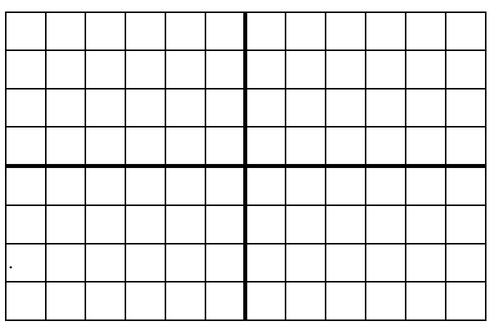


Figure 4.5a

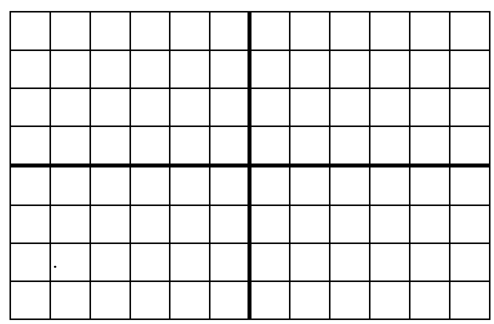


Figure 4.5b

Capacitor value = ____________

Vertical sensitivity = __________

Horizontal sensitivity = ________

Capacitor value = ___________

Vertical sensitivity = __________

Horizontal sensitivity = ________

Comment on the effect of the capacitors on the output.