

Assignment 1 electronic principles

by Lloyd John

FILE	13676_LLOYD_JOHN_ASSIGNMENT_1_ELECTRONIC_PRINCIPLES_139105_818201584.DOCX (3.41M)		
TIME SUBMITTED	28-JAN-2019 07:21PM (UTC+0000)	WORD COUNT	1671
SUBMISSION ID	99941032	CHARACTER COUNT	9593

Assignment 1

Unit 4001 – electrical and electronic engineering

Lloyd John

Contents page

Task 1	3
Transient Behaviour for the Charging of a Capacitor	3
Task 2	8
Transient Behaviour for the Discharging of a Capacitor	8
Task 3	11
Transient Behaviour for a more Complex Circuit	11
Task 4	15
Transient Behaviour for an inductive circuit.....	15

Contents list is reasonable but there should also be a list of figures

Task 1

Transient Behaviour for the Charging of a Capacitor

Task 1 is the transient behaviour for the charging of a capacitor. Below is a circuit diagram of the circuit that was tested.

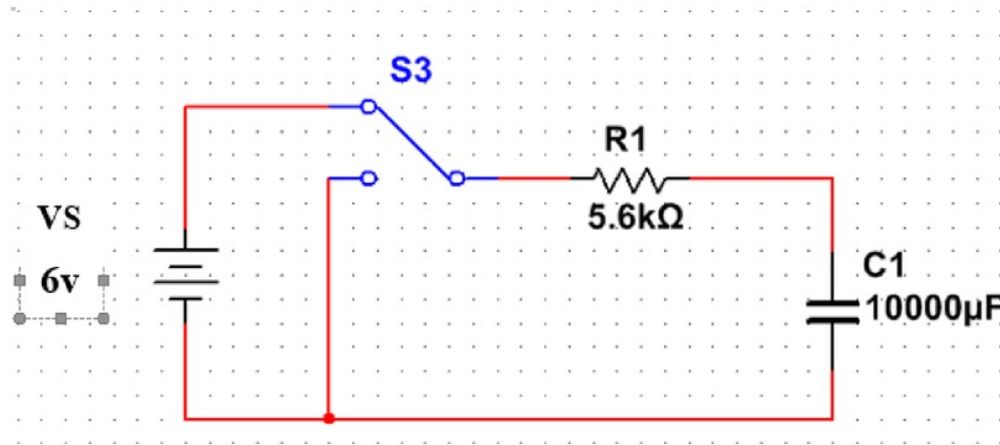


Figure 1- multisim circuit for Transient Behaviour for the Charging of a Capacitor

The reason that a $5.6\text{k}\Omega$ resistor and a $10000\mu\text{F}$ capacitor was chosen was because it provided an appropriate time constant. Time constant is the period of change. After the transient is the steady state period Time constant is calculated by $T = C \times R$ therefore $5.6\text{k} \times 10000 = 56\text{s}$. This then gave us $5T$ of 280s which was enough time to write down a good set of results but not at the same time not a very long time so we would be writing results down for 30minutes.

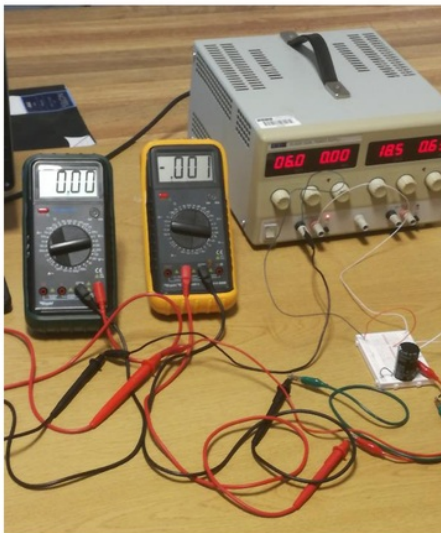


Figure 2 - practical setup

The practical was set up. The circuit was build and was connected to a power supply with an input of 6V . The circuit was also connected to two multimeters that would read voltage and current charge and discharge. Below is a picture of the practical setup.

Below is a table of results from the practical.

Image is good and explanation includes good points

Charge results are correct

Time(t)	VC(V)	IC(A)
20	1.91	0.701
40	3.09	0.491
60	3.91	0.352
80	4.47	0.25
100	4.89	0.179
120	5.18	0.129
140	5.39	0.094
160	5.54	0.069
180	5.64	0.051
200	5.72	0.038
220	5.77	0.028
240	5.81	0.022
260	5.84	0.016
280	5.86	0.013

Table of results for voltage and current charge:

I was now able to use these values for the 3 random times I chose which included 120, 180 and 230s.

I then calculated values for voltage and current charge using my 3 chosen times with the equations below:

$VC = V_{\max} (1 - e^{-t/T})$ for voltage charge:

$VC = 6(1 - e^{-120/56}) = 5.29V$

$VC = 6(1 - e^{-180/56}) = 5.76V$

$VC = 6(1 - e^{-230/56}) = 5.901V$

Avoid using first person terms
Calcs for Vc are correct

And $IC = I_{\max} (e^{-t/T})$ for current charge.

$IC = 1.07(e^{-120/56}) = 125.532mA$

$IC = 1.07(e^{-180/56}) = 42.99mA$

$IC = 1.07(e^{-230/56}) = 17.606mA$

Calcs for Ic are incorrect. the units are uA. Imax is 1.07mA

*Avoid using first
person terms*

I was also able to set up a multisim of the circuit and record 3 results from my chosen times as well as 0.7T which is 39.2s and 1T which is 56s. Below is a screenshot of the circuit as well as a picture of a transient analysis from the circuit below which shows voltage charge and current charge.

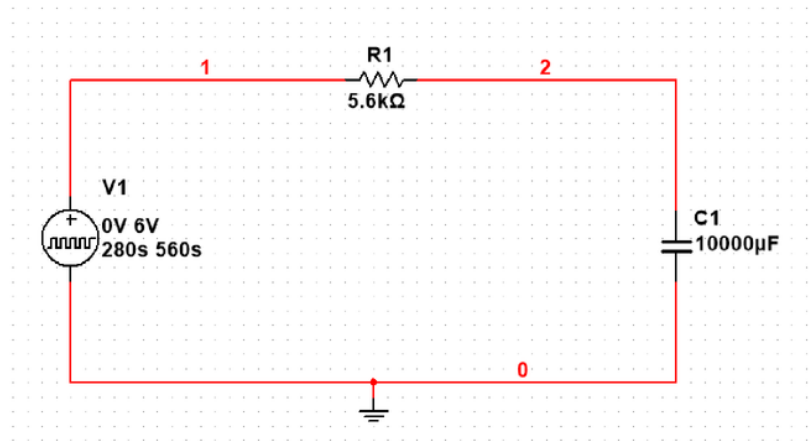


Figure 3 - multisim of charging and discharging of capacitor circuit

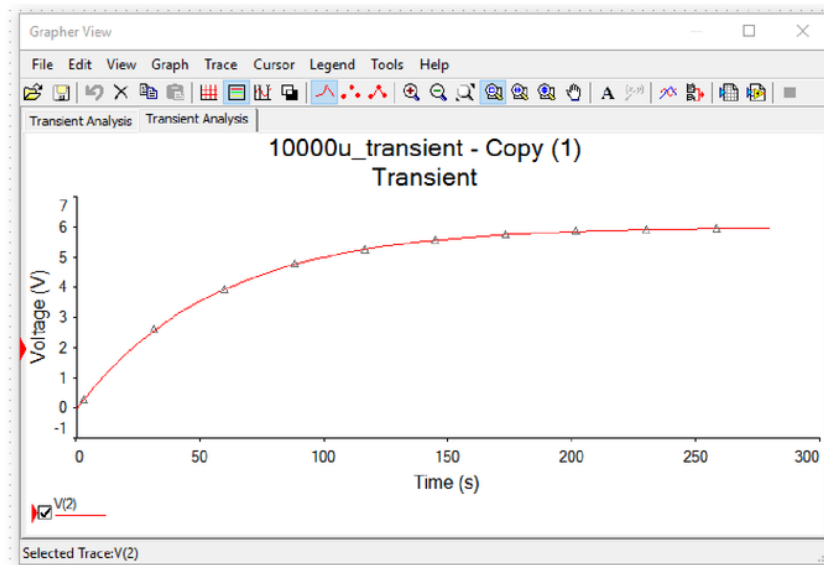


Figure 4 - transient analysis for charging of capacitor for voltage

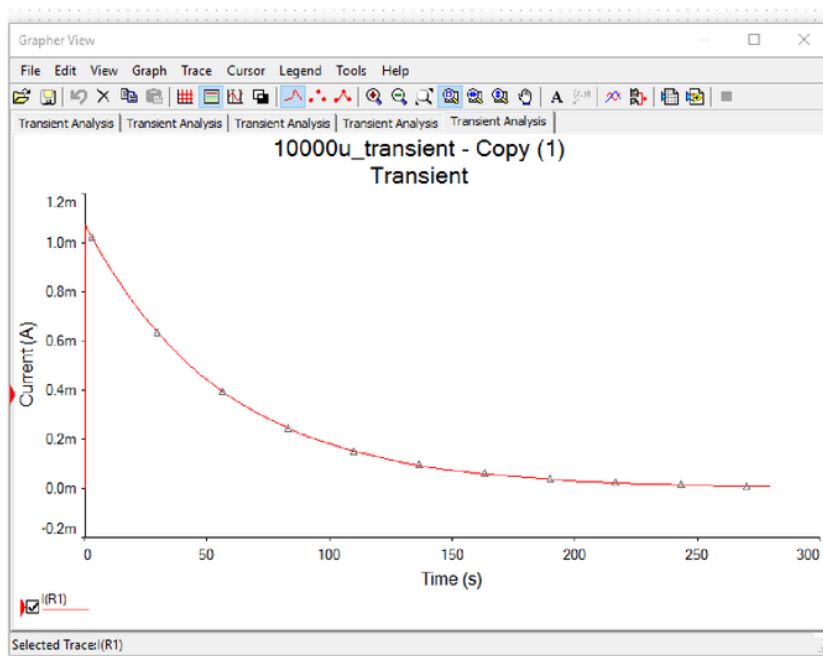


Figure 5 - transient analysis for charging of capacitor for current

Below are tables of results for voltage and current charge for my 3 chosen times as well as 0.7T and 1T for calculated, measured and simulated values:

Voltage charge

Good use of
tables for
correct values

Instantaneous time (s)	Calculated values(v)	Measured values (v)	Simulation values(v)
39.2	3.02	3.09	3.016
56	3.79	3.82	3.79
120	5.29	5.18	5.29
180	5.76	5.64	5.76
230	5.901	5.79	5.902

Current charge

Ic values should be mA

Instantaneous time (s)	Calculated values(A)	Measured values (A)	Simulation values(A)
39.2	0.53	0.491	0.533
56	0.394	0.383	0.394
120	0.125	0.129	0.125
180	0.043	0.051	0.427
230	0.017	0.025	0.017

Below is a screenshot of 2 results from the transient response for voltage charge including 120s and 180s.

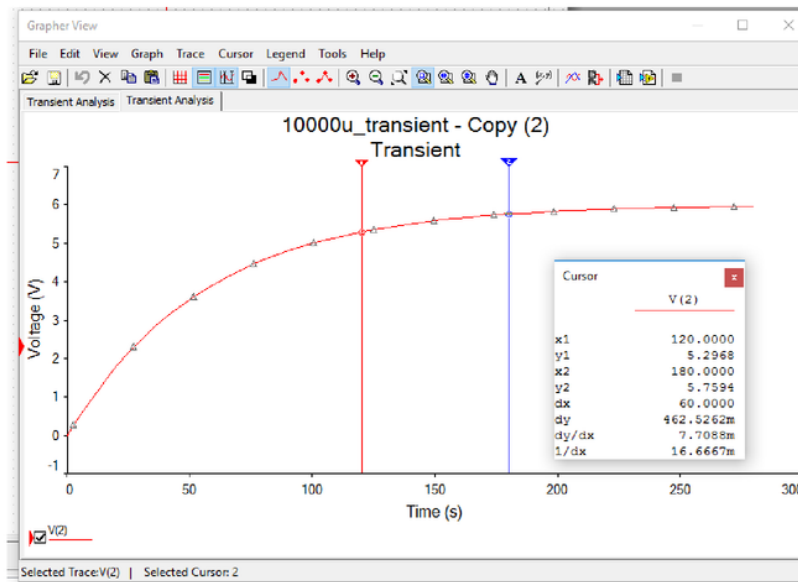


Figure 6 - transient response for voltage charge

Task 2

Avoid first person terms

Transient Behaviour for the Discharging of a Capacitor

With the circuit from fig 1, which is now in discharge state, I took voltage and current readings until both parameters met 0. Below is a table of results from the practical that shows values for voltage and current discharge over a period of 280s.

Time(t)	VC(V)	IC(A)
20	4.09	-0.705
40	2.92	-0.506
60	2.05	-0.357
80	1.45	-0.253
100	1.04	-0.181
120	0.75	-0.129
140	0.53	-0.092
160	0.38	-0.066
180	0.27	-0.047
200	0.20	-0.034
220	0.14	-0.025
240	0.10	-0.018
260	0.08	-0.013
280	0.05	-0.010

Table of values is correct

I used the same time values from charge for discharge.

I then calculated values for voltage and current charge using my 3 chosen times with the equations below:

$VC=VS (e^{-t/T})$ for voltage discharge

$$VC=6 (e^{-120/56}) =0.704V$$

$$VC=6 (e^{-180/56}) =0.241V$$

Calcs for Vc are correct

$$VC=6 (e^{-230/56}) =0.099V$$

And $IC=-I_{max} (e^{-t/T})$ for current discharge

$$IC= -1.07(e^{-120/56}) =-0.126A$$

$$IC= -1.07(e^{-180/56}) =-0.043A$$

This should be mA

$$IC=-1.07(e^{-230/56}) =-0.018A$$

Using the multisim of the circuit, the output was changed so that it would show the discharging of the circuit, I was then able to use my 3 chosen times as well as 0.7T which is 39.2s and 1T which is 56s to collect values for voltage and current discharge. Below is a screenshot of the circuit as well as a picture of a transient analysis from the circuit below which shows voltage discharge and current discharge.

Why 0.7T and 1T ?

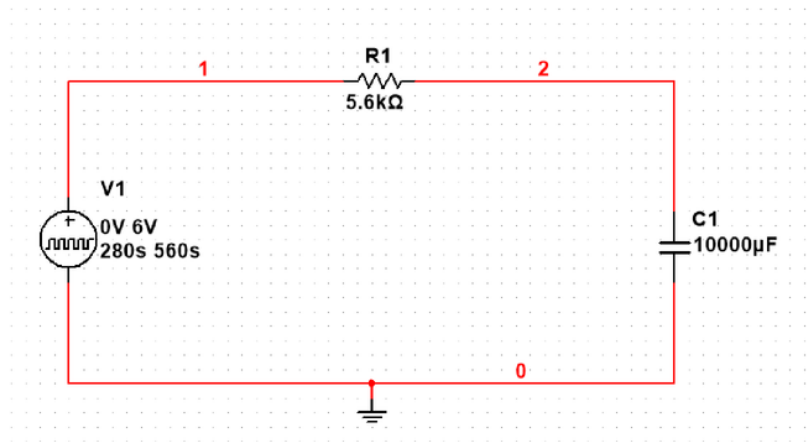


Figure 7 - multisim of charging and discharging of capacitor circuit

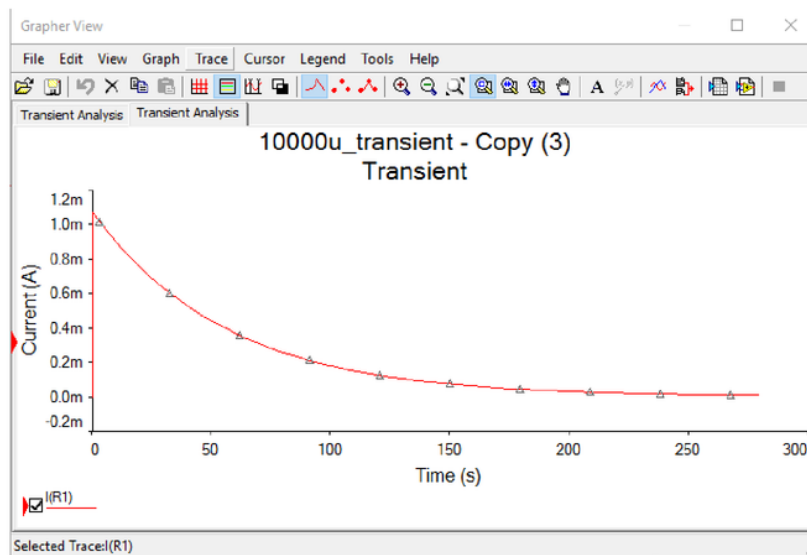
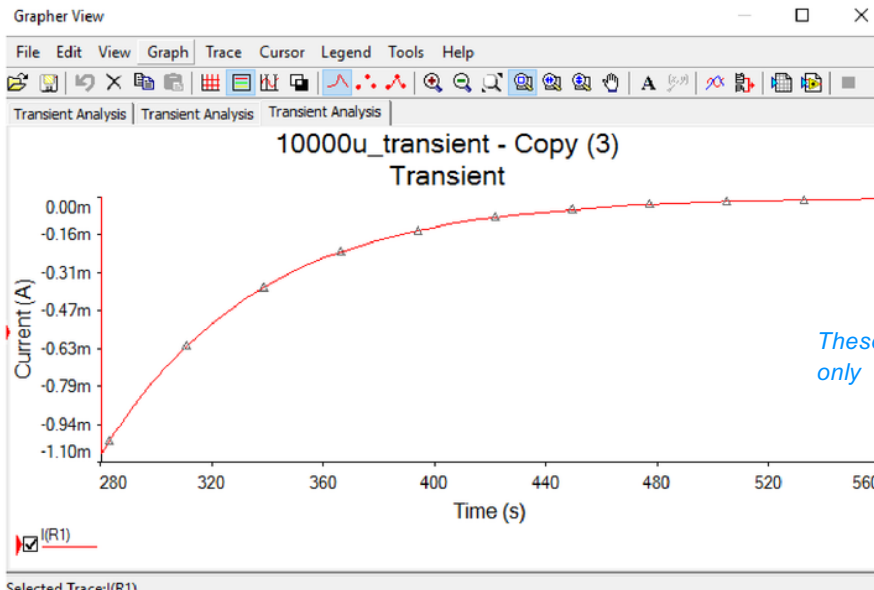


Figure 8 - - transient analysis for discharging of capacitor for voltage



Theses graphs show the trends only

Figure 9 - transient analysis for discharging of capacitor for current

Below are tables of results for voltage and current discharge for my 3 chosen times as well as 0.7T and 1T for calculated, measured and simulated values:

Voltage discharge

Instantaneous time (s)	Calculated values(v)	Measured values (v)	Simulation values(v)
39.2	2.98	2.92	2.955
56	2.207	2.02	2.198
120	0.704	0.75	0.697
180	0.241	0.27	0.238
230	0.099	0.12	0.081

Good use of tables for analysis

Current discharge

Instantaneous time (s)	Calculated values(A)	Measured values (A)	Simulation values(A)
39.2	-0.53	-0.506	-0.527
56	-0.394	-0.349	-0.392
120	-0.125	-0.129	-0.124
180	-0.043	-0.047	-0.042
230	-0.017	-0.021	-0.017

The units should be mA here

Task 3

Transient Behaviour for a more Complex Circuit

The complex circuit below was used to perform a transient behaviour.

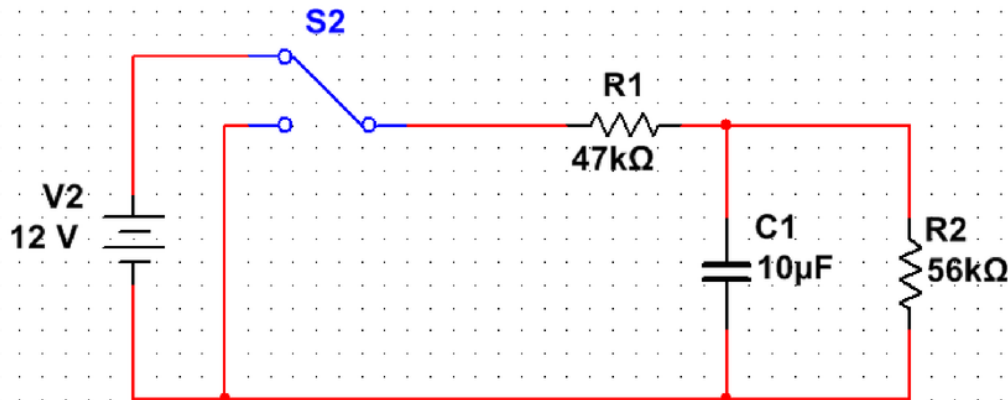
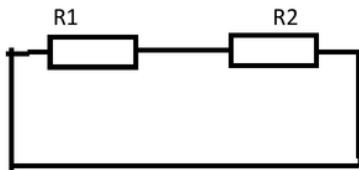


Figure 10 - complex circuit

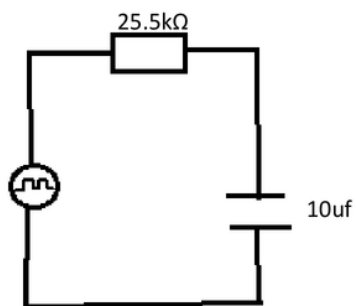
The equivalent circuit for this is shown below where the capacitor and supply has been removed:



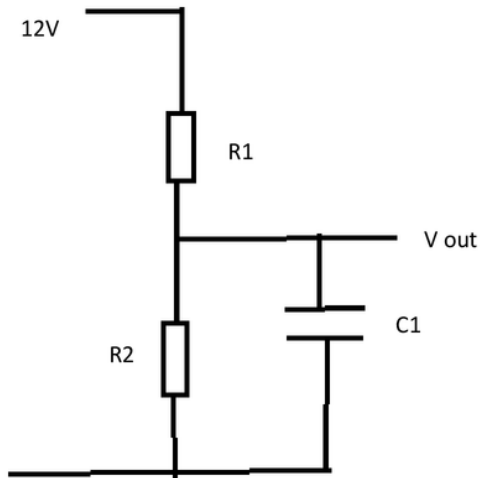
As this is now a parallel circuit we can say:

$$R1 \times R2 / R1 + R2 = 47 \times 56 / 47 + 56 = 25.5k\Omega$$

Now we can add the capacitor back in:

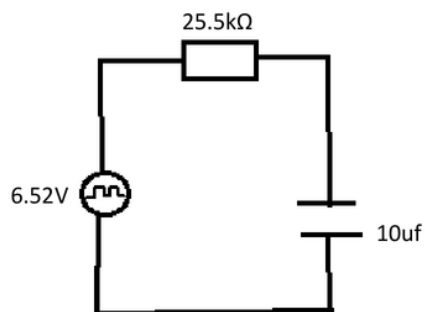


Next I can solve the voltage divider for V_s , this is shown below:



$$V_c \text{ max} = R_2 / (R_1 + R_2) = 6.52V$$

Our new equivalent circuit is shown below:



Equivalent cct is correct

We can now work out the time constant by using the equation $T = R \times C$ where $R = 25.5k$ and

$C = 10\mu f$. Therefore $25.5k \times 10\mu f = 0.255$. We can then work out $5T$ by $5 \times 0.255 = 1.275s$.

Pulse width = 1.275s

Period = $1.275 \times 2 = 2.55$

Now that we have the transient period we can use this to calculate the charge voltage and current as well as discharge voltage and current.

Parameters for test are identified

Charge voltage

The equation for voltage charge is $VC = VS (1 - e^{-t/T})$

$$VC = 6.52 (1 - e^{-0.5/0.255}) = 5.602$$

$$VC = 6.52 (1 - e^{-1/0.255}) = 6.391$$

Calcs are correct

Charge current

$$IC = I_{\max} (e^{-t/T})$$

$$IC = 0.255 (e^{-0.5/0.255}) = 0.0359A$$

$$IC = 0.255 (e^{-1/0.255}) = 5.052mA$$

Formula is correct but calcs are incorrect

Discharge voltage

$$VC = VS (e^{-t/T})$$

$$VC = 6.52 (e^{-0.5/0.255}) = 0.918V$$

$$VC = 6.52 (e^{-1/0.255}) = 0.129V$$

Calcs are correct

Discharge current

$$IC = -I_{\max} (e^{-t/T})$$

$$IC = -0.255 (e^{-0.5/0.255}) = -0.0359A$$

$$IC = -0.255 (e^{-1/0.255}) = -5.052mA$$

Incorrect calcs

Below is a multisim simulation of the above circuit:

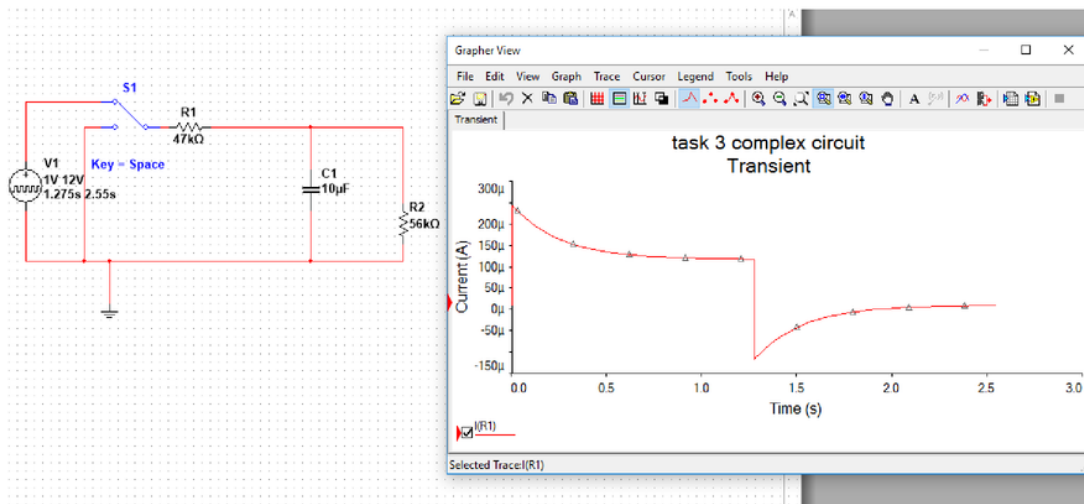


Figure 11 - multisim of complex circuit with transient response

Next I need to calculate the initial and final currents taken from the supply. This is shown below:

Imax initial current can be worked out using the calculation V/R_1 therefore:

$$\frac{12}{47k} = 25.53mA \text{ Which is our initial current.}$$

*This
should
be*

The final current can be calculated using the equation $V/R_1 + R_2$ therefore:

$$\frac{12}{47k} + 56k = 0.11mA \text{ Which is our final current.}$$

*0.255mA
A
The
answer
here is
correct
but the
formula
is
incorrect*

Task 4

Transient Behaviour for an inductive circuit

i) Below is an inductive circuit built on multisim:

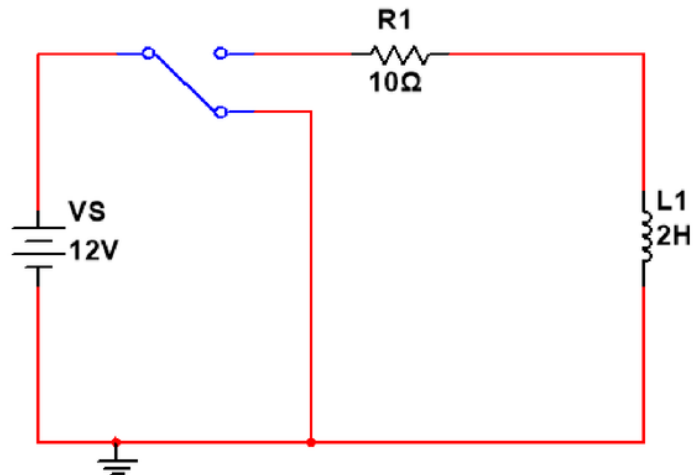


Figure 12 - inductive circuit on multisim

First of all I need to use multisim to show the current growth for the first one second after the voltage source is applied to the circuit. Below is the multisim that shows this growth:

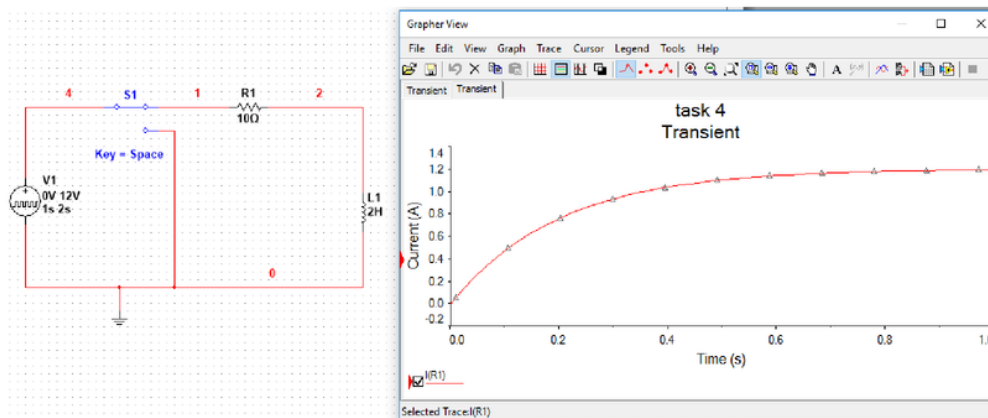


Figure 13 - multisim of inductive circuit with growth for the first second after source is applied

ii) I now need to carry out calculations. Below are calculations for charge and discharge for 3 instantaneous times for current through the inductor:

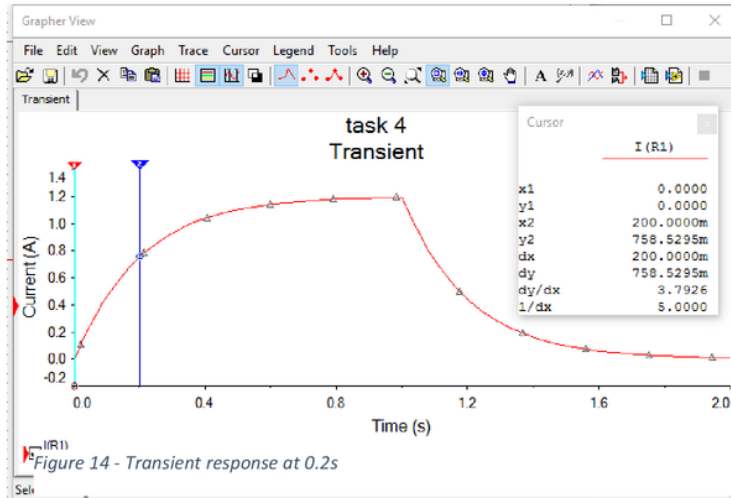
Charge

$$IL = I_{max}(1 - e^{-R/Lxt})$$

$$I_{max} = \frac{V}{R} = \frac{12}{10} = 1.2A$$

Now for the 3 charge equations:

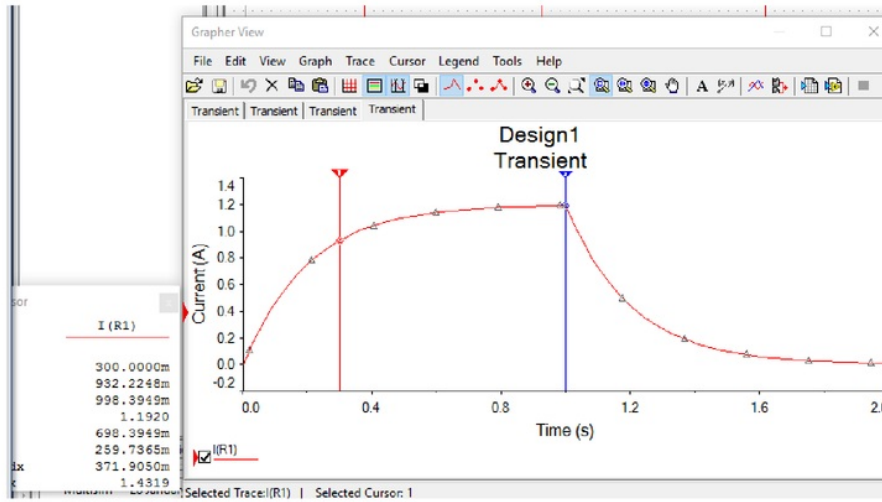
$$1.2(1 - e^{-10/2 \times 0.2}) = 0.758A$$



As you can see in the cursor data, at 0.2s, the current is 0.7585A.

Calc and graph are correct here

$$1.2(1 - e^{-10/2 \times 0.3}) = 0.93A$$

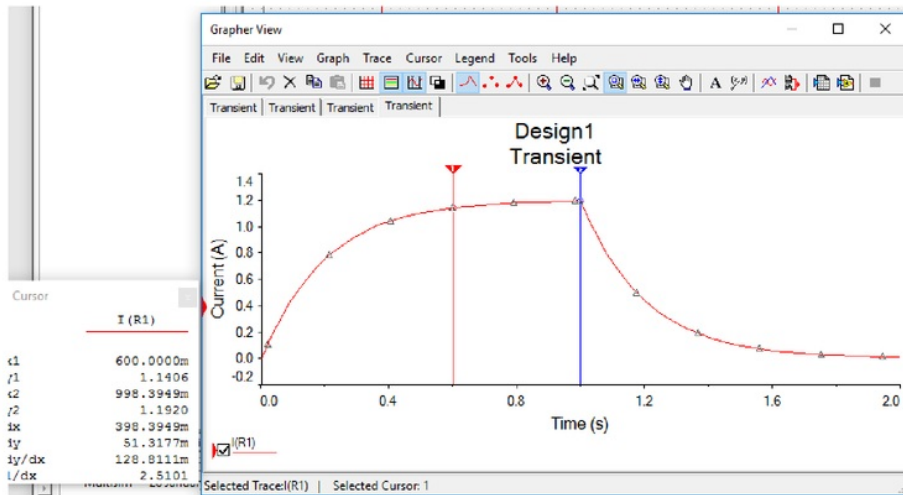


As you can see in the cursor data, at 0.3s current is at 0.9322A.

Calc and graph are correct

Figure 15 - Transient response at 0.3s

$$1.2(1 - e^{-10/2 \times 0.6}) = 1.14A$$

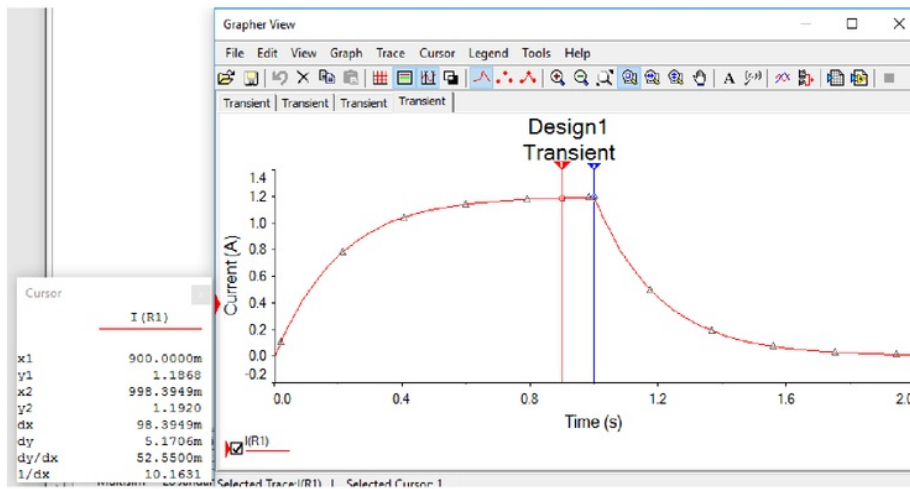


As you can see in the cursor data, at 0.6s, current is at 1.1406A.

Calc and graph are correct

Figure 16 - Transient response at 0.6s

$$1.2(1 - e^{-10/2 \times 0.9}) = 1.19$$



As you can see in the cursor data, at 0.9s, current is at 1.186A.

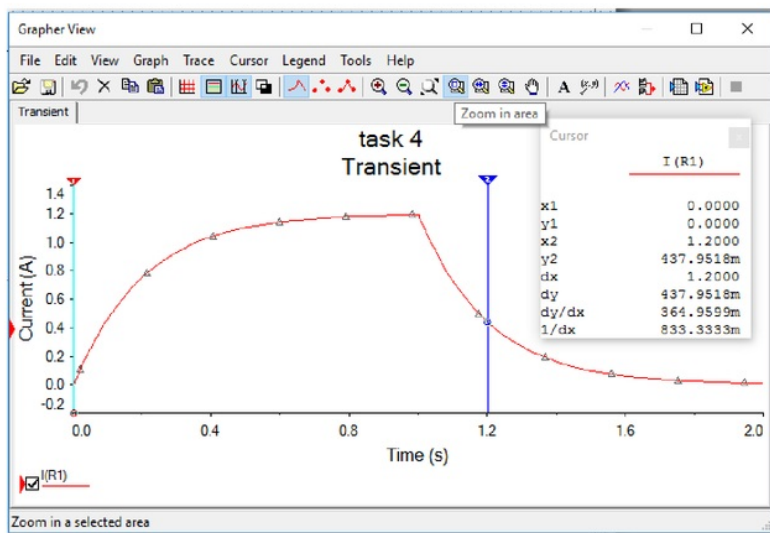
Calc and graph are correct

Figure 17 - Transient response at 0.9s

Discharge

$$I_{max}(e^{-R/L \times t})$$

$$1.2(e^{-10/2 \times 0.2}) = 0.441A$$

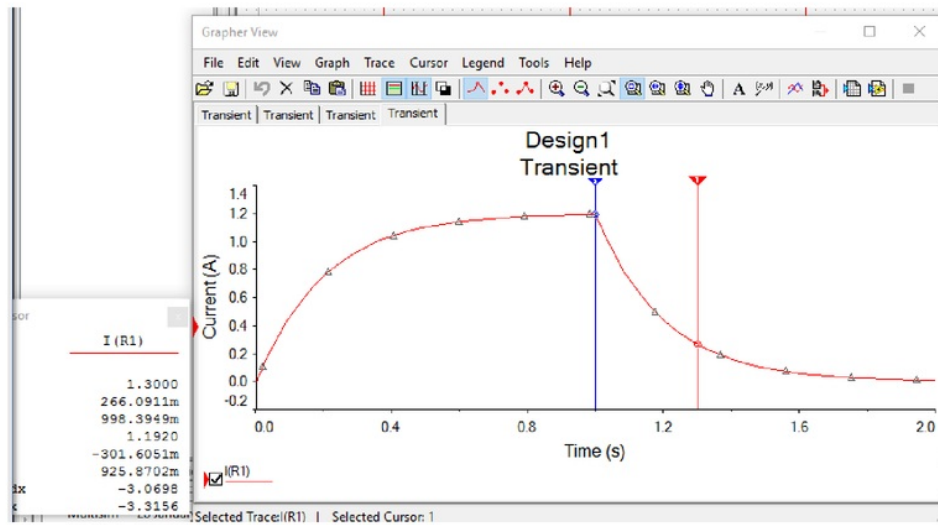


As you can see in the cursor data, at 0.2s, the current is 0.4379A

Calc and graph are correct

Figure 18 - Transient response at 0.2s

$$1.2(e^{-10/2 \times 0.3}) = 0.268A$$



As you can see in the cursor data, at 0.3s, the current is 0.266A.

Figure 19 - Transient response at 0.3s

$$1.2(e^{-10/2 \times 0.6}) = 0.059A$$

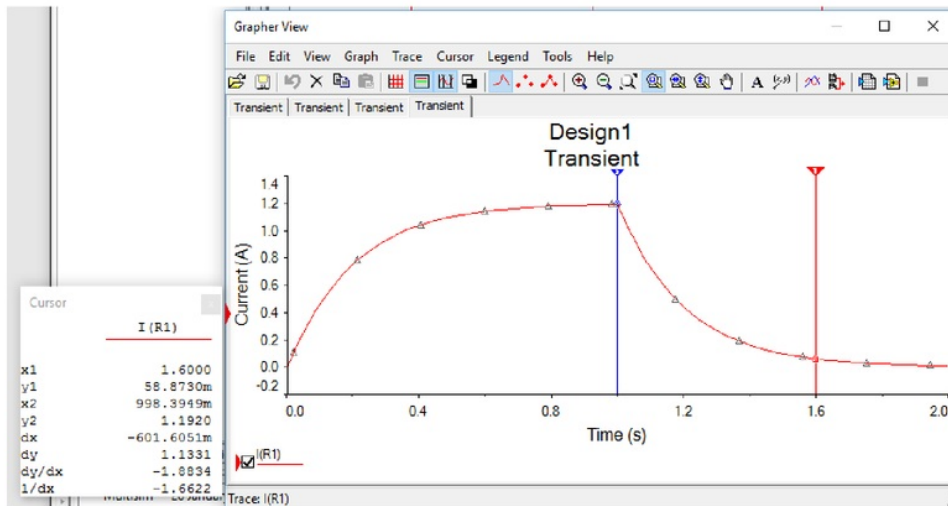


Figure 20 - Transient response at 0.6s

As you can see in the cursor data, at 1.6s, the current is 0.0588A.

$$1.2(e^{-10/2 \times 0.9}) = 0.013A$$

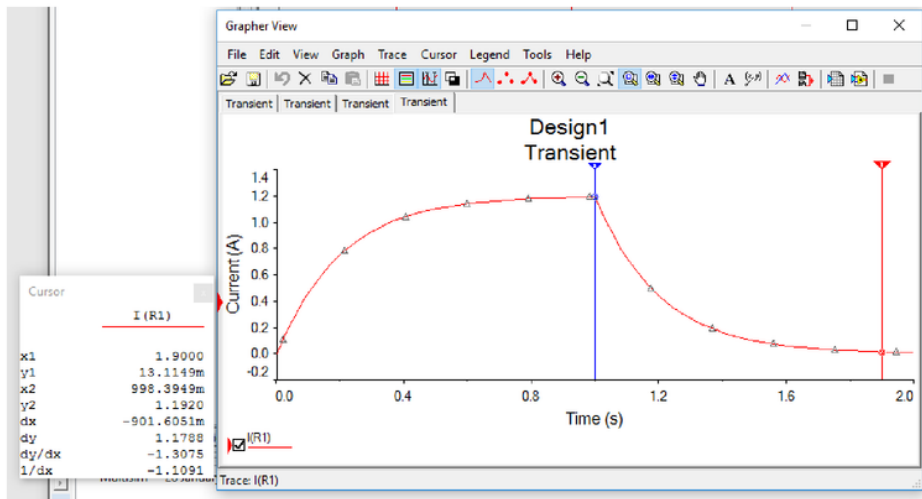


Figure 21 - Transient response at 0.9s

As you can see in the cursor data, at 1.9s, the current is at 0.0131A.

Below is a graph on excel of charge and discharge against current:

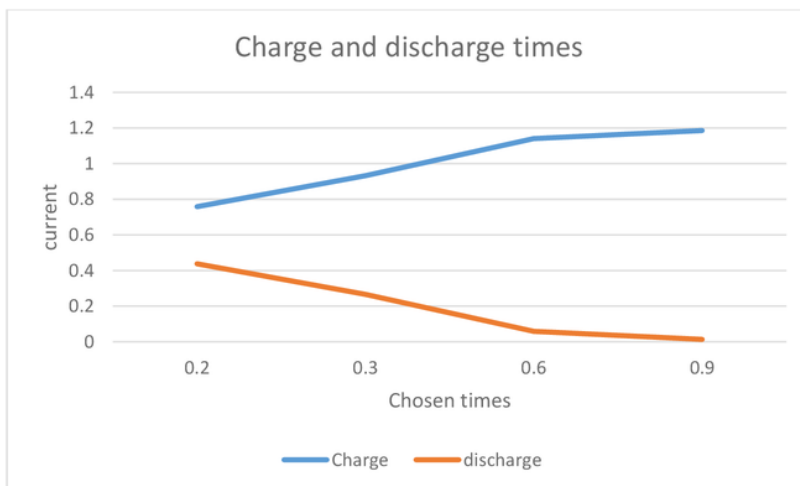
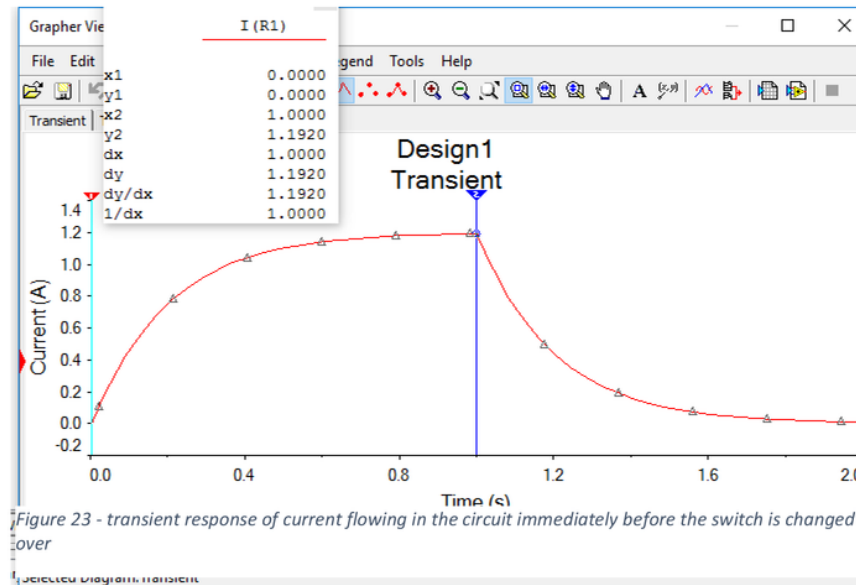


Figure 22 - graph of charge and discharge times

Graphs and calcs are correct

Graph trend could be better. Both lines should be curves but the directions are correct

iii) Here I needed to determine the current flowing in the circuit immediately before the switch is changed over. As you can see the cursor shows that its at 1s in time and the current is shown to be 1.1920A.



As you can see in the cursor data the current at the I_{max} point at 1s is 1.192A which is close to the 1.2A that we calculated

iv) I can now calculate the time constant of the circuit as $T = L/R$ which is shown below:

$$\frac{2}{10} = 0.2s$$

I can then work out $5T$ which is $5 \times 0.2 = 1$.

Period can then be calculated by doubling $5T$ therefore $1 \times 2 = 2$

v) Now I need to calculate the time that elapses before the current flowing in the circuit has fallen to 100mA and 10mA.

First of all we need the calculation which is worked out below:

$$I_L = I_{max} (e^{-R/L \times t})$$

$$= I_L / I_{max} = e^{-R/L \times t}$$

$$\ln \times (I_L / I_{max}) = \ln (e^{-R/L \times t})$$

$$\ln \times (I_L / I_{max}) = -R/L \times t$$

$$T = L/R$$

$$\text{Therefore } 1/T = R/L$$

$$\ln \times (I_L / I_{max}) = -t/T$$

Now we have our final equation which is shown here: $t = T(\ln(I_L/I_{max}))$ and we can calculate the time that elapses before the current that flows in the circuit has fallen to 100mA and 10mA.

$$0.2(\ln(0.1/0.6)) = 0.358$$

$$0.2(\ln(0.01/0.6)) = 0.819$$

*I_{max} here is 0.6? when
I_{max} should be 1.2A
Formula is correct but
calcs are incorrect*

Assignment 1 electronic principles

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

44/100

PAGE 1

PAGE 2

Text Comment. Contents list is reasonable but there should also be a list of figures

PAGE 3

Text Comment. Image is good and explanation includes good points

PAGE 4

Text Comment. Charge results are correct

Text Comment. Avoid using first person terms

Text Comment. Calcs for V_c are correct

Text Comment. Calcs for I_c are incorrect. the units are μA . I_{max} is 1.07mA

PAGE 5

Text Comment. Avoid using first person terms

PAGE 6

Text Comment. Good use of tables for comparison

Text Comment. I_c values should be mA

PAGE 7

Text Comment. Avoid first person terms

Text Comment. Table of values is correct

Text Comment. Calcs for V_c are correct

Text Comment. This should be mA

Text Comment. Why 0.7T and 1T ?

Text Comment. Theses graphs show the trends only

Text Comment. Good use of tables for analysis

Text Comment. The units should be mA here

Text Comment. No Sim graphs or practical graphs are present for comparison

Text Comment. Equivalent cct is correct

Text Comment. Parameters for test are identified

Text Comment. Calcs are correct

Text Comment. Formula is correct but calcs are incorrect

Text Comment. Calcs are correct

Text Comment. Incorrect calcs

Text Comment. This should be 0.255mA

Text Comment. The answer here is correct but the formula is incorrect

Text Comment. Calc and graph are correct here

Text Comment. Calc and graph are correct

Text Comment. Calc and graph are correct

Text Comment. Calc and graph are correct

Text Comment. Calc and graph are correct

Text Comment. Graphs and calcs are correct

Text Comment. Graph trend could be better. Both lines should be curves but the directions are correct

Text Comment. I_{max} here is 0.6? when I_{max} should be 1.2A Formula is correct but calcs are incorrect

LLOYD JOHN

0

RESEARCH-INFORMED LITERATURE



N/a

KNOWLEDGE AND UNDERSTANDING



Intro to practical and assessment topic area was weak with very few good points. Showed a non convincing understanding. 4/10 Results and discussion were weak with very few points identified. Many parts were missing from report. The final task was the best effort. 8/15

12/25

ANALYSIS



Testing was carried out with good results. Only part of the analysis was completed. No sim values were present in tasks 1, 2 and 3. Explanations were weak. Many errors in the report but there were areas that are correct. 14/30 Not many conclusions on the individual tasks or final conclusion. 3/10

17/40

PRACTICAL APPLICATION AND DEP.



Circuit testing was carried out competently and the

results were obtained effectively. Many parts missing in the report including the graph plots of the prac results. 7/15 The quality of results was good for the prac. Explanations were weak. Methods of testing showed a good understanding of the practical tasks but the sim values were not present. There were also errors in calcs. 4/10

11/25

SKILLS FOR PROFESSIONAL PRAC.



Report was weak and many parts were missing.
3/10

4/10