

## LEVEL 5 ASSESSMENT SPECIFICATION

|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                 |                      |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------|
| <b>Student name:</b>                   | <b>Carys Williams</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Student ID number:</b>                                       |                      |
| <b>Programme:</b>                      | <b>HND/HNC Electrical/Electronic Engineering, HNC Instrumentation Engineering &amp; HNC Power System Engineering</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                 |                      |
| <b>Module:</b>                         | <b>Electrical Principles, Methods and Simulation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                 |                      |
| <b>Module code:</b>                    | <b>PSDE5009</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Contribution to Overall Module Assessment (%):</b>           | <b>50%</b>           |
| <b>Lecturer:</b>                       | <b>Jason Pointer</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Internal Verifier:</b>                                       | <b>Steve Roberts</b> |
| <b>Assignment Title:</b>               | <b>Analogue Systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Word count (or equivalent):</b>                              | <b>2000</b>          |
| <b>Submission deadline:</b>            | <b>07/02/19</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Return date of provisional marks &amp; written feedback:</b> |                      |
| <b>Submission method:</b>              | <p>All written assessments, where practical and possible, must be submitted via Turnitin unless otherwise instructed by the Lecturer. (Please DO NOT put this assessment specification into Turnitin or it will match many similarities with other students' submissions.)</p> <p><b>Alternative submission method (if applicable):</b></p> <p><b>Late submission of the assessment will result in a late penalty mark.</b> Penalties for late submission: Up to one week late, maximum mark of 40%. Over one week late, 0%. Only the Extenuating Circumstances Panel may approve a change to submission dates.</p> |                                                                 |                      |
| <b>Academic honesty / referencing:</b> | <p>Academic honesty is required. In the main body of your submission you must give credit to authors on whose research and ideas your work is based. Append to your submission a reference list that indicates the books, articles, etc. that you have used, cited or quoted in order to complete this assessment.</p>                                                                                                                                                                                                                                                                                              |                                                                 |                      |

### Module Learning Outcomes (from module syllabus)

1. Analyse and **evaluate electrical circuits, electronic systems** and control systems.
2. Simulate standard **electrical circuits, electronic systems** and control systems.

# STUDENT FEEDBACK FORM

This section details the *extent* to which the assessment criteria are demonstrated by you, which in turn determines your mark. The marks available for each category of skill are shown. Lecturers will use the space provided to comment on the achievement of the task(s), including those areas in which you have performed well and areas that would benefit from development/improvement.

| Generic Assessment Criteria                                                                                                                                                                                                                                                                                                                                         | Marks available | Marks awarded |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|
| <b>1. Engagement with Literature Skills</b>                                                                                                                                                                                                                                                                                                                         | 0               | 0             |
|                                                                                                                                                                                                                                                                                                                                                                     |                 |               |
| <b>2. Knowledge and Understanding Skills</b>                                                                                                                                                                                                                                                                                                                        | 20              | 13.4          |
| Achieved 60% for Task 1.<br>Achieved 70% for Task 2.<br>Achieved 50% for Task 3.<br>Achieved 85% for Task 4.<br>Achieved 70% for Task 5.<br>Knowledge is reasonably extensive and accurate in most parts. Show a very good understanding of most concepts and principles covered by this assignment but not all of the elements were covered for some of the tasks. |                 |               |
| <b>3. Cognitive and Intellectual Skills</b>                                                                                                                                                                                                                                                                                                                         | 20              | 2.5           |
| Achieved 30% for Task 1.<br>Achieved 0% for Task 3.<br>Achieved 7% for Task 5.<br>For the tasks that asked for comments the work was almost wholly descriptive. Little or no critical evaluation and analysis of concepts and principles covered by these tasks.                                                                                                    |                 |               |
| <b>4. Practical Application Skills</b>                                                                                                                                                                                                                                                                                                                              | 50              | 35.4          |
| Achieved 60% for Task 1.<br>Achieved 60% for Task 2.<br>Achieved 70% for Task 3.<br>Achieved 85% for Task 4.<br>Achieved 65% for Task 5.<br>Achieved 85% for Task 6.<br>A very good application of established methods in the use of Matlab, Multisim and practical work but in places not all of the required work was produced.                                   |                 |               |
| <b>5. Transferable Skills for Life and Professional Practice</b>                                                                                                                                                                                                                                                                                                    | 10              | 5             |
| Mostly coherent, organised and accurate work, in a suitable structure and is for the most part clearly expressed. There were a few spelling mistakes in the assignment, need to read through the work to minimize some of these errors.                                                                                                                             |                 |               |

**Assessment Mark** (Assessment marks are subject to ratification at the Exam Board. These comments and marks are to give feedback on module work and are for guidance only until they are confirmed. )

**Late Submission Penalties (tick if appropriate)**

Up to 1 week late (40% Max)

Over 1 week late (0%)

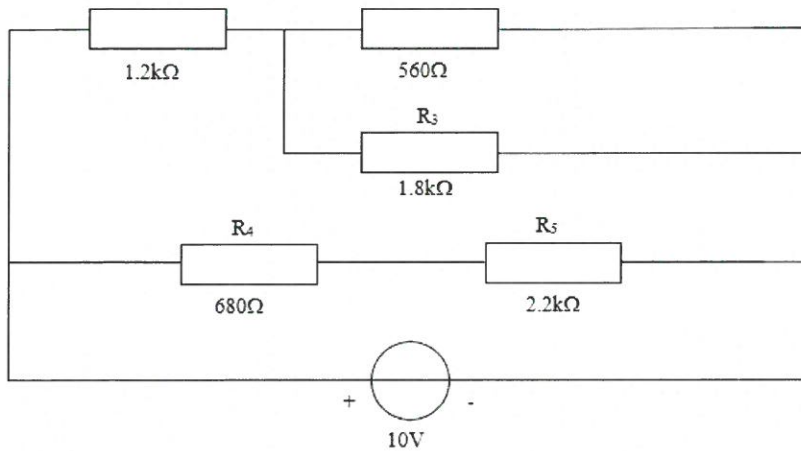
**56%**

Course Title: HND Electrical/Electronic Engineering  
Module: Electrical Principles, Methods & Simulation  
Assignment Number: 1  
Assignment Title: Analogue Systems  
Student Name: Carys Williams  
Student Number: 110538  
Date Hand Out: 18/10/2018  
Date Hand In: 07/02/2019  
Lecturer Name: Jason Pointer

## **Content Page**

|              |              |
|--------------|--------------|
| Front Cover  | Page 1       |
| Content Page | Page 2       |
| Task 1       | Page 3 - 5   |
| Task 2       | Page 6       |
| Task 3       | Page 7 - 9   |
| Task 4       | Page 10 - 11 |
| Task 5       | Page 12 - 13 |
| Task 6       | Page 14 - 15 |
| Appendix     | Page 16      |

## Task 1



For the following task it will discuss about a DC combination Circuit. The circuit below shows the resistor values and the voltage value. This circuit was constructed on a bread board and simulation. A table has been provided which will show the value that were calculated as well as the value obtained from both simulation and the practical.

Table 1 as stated above dose show all the values that were obtained and calculated. To show that the values in the table are the true values. Below shows the calculations that were required to be able to get the value for each resistor. The calculations are as followed:

| Table of Values (DC circuit Task 1) |                        |                       |                      |
|-------------------------------------|------------------------|-----------------------|----------------------|
| Resistor (Ω)                        | Calculated Voltage (V) | Simulated Voltage (V) | Measured Voltage (V) |
| R1 (1.2k)                           | 7.38                   | 7.38                  | 7.33                 |
| R2 (560)                            | 2.63                   | 2.63                  | 2.65                 |
| R3 (1.8k)                           | 2.63                   | 2.63                  | 2.65                 |
| R4 (680)                            | 2.36                   | 2.36                  | 2.36                 |
| R5 (2.2k)                           | 7.64                   | 7.64                  | 7.62                 |

$$R4 + R5 \approx 680 + 2.2k = 2880\Omega$$

$$I_1 = \frac{V}{R_{ms}} = \frac{10}{2880} = 3.47 \times 10^{-3} \text{ A}$$

$$V4 = I_1 \times R4 \approx (3.47 \times 10^{-3}) \times 680 = 2.36v$$

$$V5 = I_1 \times R5 \approx (3.47 \times 10^{-3}) \times (2.2 \times 10^3) = 7.63v$$

$$R_{23} = \frac{R2 \times R3}{R2 + R3} = \frac{560 \times (1.8 \times 10^3)}{560 + (1.8 \times 10^3)} = 427.12\Omega$$

$$R_{123} = R1 + R_{23} \approx (1.2 \times 10^3) + 427.12 = 1627.12 \Omega$$

$$I_2 = \frac{10}{1627.12} = 6.15mA$$

$$V1 = I_2 \times R1 \approx (6.15 \times 10^{-3}) \times (1.2 \times 10^3) = 7.38v$$

$$V23 = V - V1 \approx 10 - 7.38 = 2.62v$$

Due to the way the circuit is designed the value for resistor 2 and 3 are equal. This is due to the two resistors being in parallel with each other.

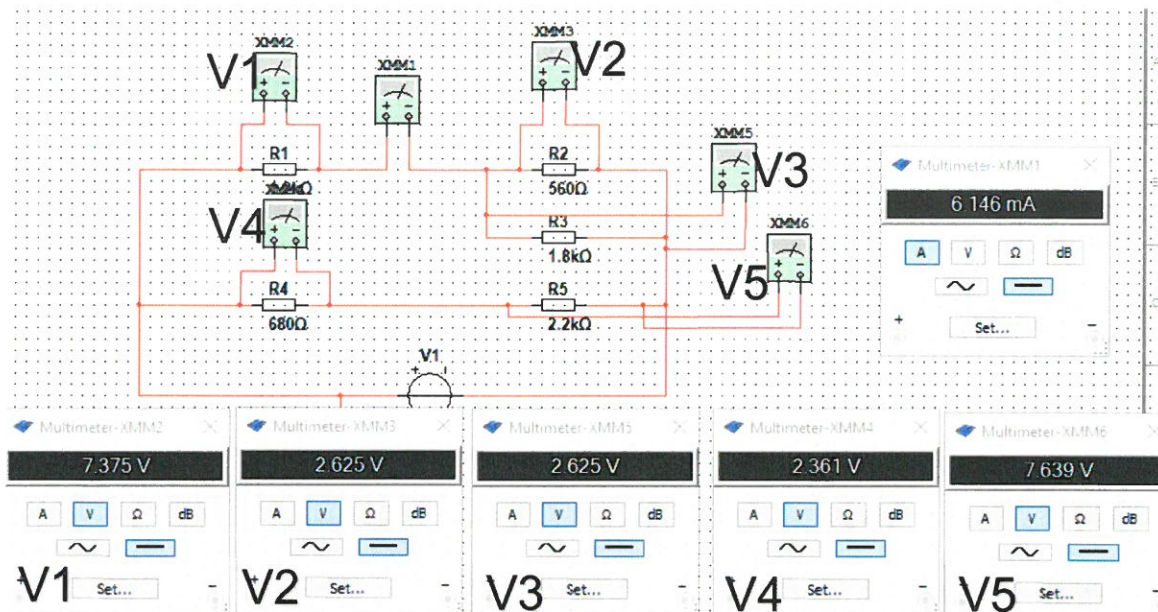


Diagram 2 shows the simulation program that was created to follow the circuit that was given. As seen on the multimeter that are connected to the circuit it shows all the values that are presented in the table. The other multimeter that has not been labelled was connected to ensure that the current through the circuit was correct. Due to having trouble gaining the correct value.

When the simulation had been completed another part of the task was to create a MATLAB program that would calculate all the voltage values in this type of circuit. This wasn't difficult to do due to the fact that the calculation have already been done above and all that was required was to write it in code for the computer to understand. However, when sorting out the part of the code to allow the user to insert values took some time.

```

Command Window
New to MATLAB? Watch this Video, see Demo X

Enter the voltage:10
Enter the value for R1:1200
Enter the value for R2:560
Enter the value for R3:1800
Enter the value for R4:680
Enter the value for R5:2200
The Voltage across R1 is:
7.3750

The Voltage across R2 is:
2.6250

The Voltage across R3 is:
2.6250

The Voltage across R4 is:
2.3611

The Voltage across R5 is:
7.6389

fx >>

Workspace
Name      Value
-----
I1         0.0035
I2         0.0061
R1         1200
R123       1.6271e+03
R2         560
R23        427.1186
R3         1800
R4         680
R5         2200
V          10
V1         7.3750
V2         2.6250
V3         2.6250
V4         2.3611
V5         7.6389
  
```

This image (diagram 3) is a screen shot showing the original values from the circuit and the result that MATLAB has provided. Half of the screen shot shows what the code had been asked to do. The other half shows all the calculation the program had actually done in order to get the results needed.

```

Enter the voltage:15
Enter the value for R1:3000
Enter the value for R2:690
Enter the value for R3:7000
Enter the value for R4:8500
Enter the value for R5:100
The Voltage across R1 is:
12.4032

The Voltage across R2 is:
2.5968

The Voltage across R3 is:
2.5968

The Voltage across R4 is:
14.8256

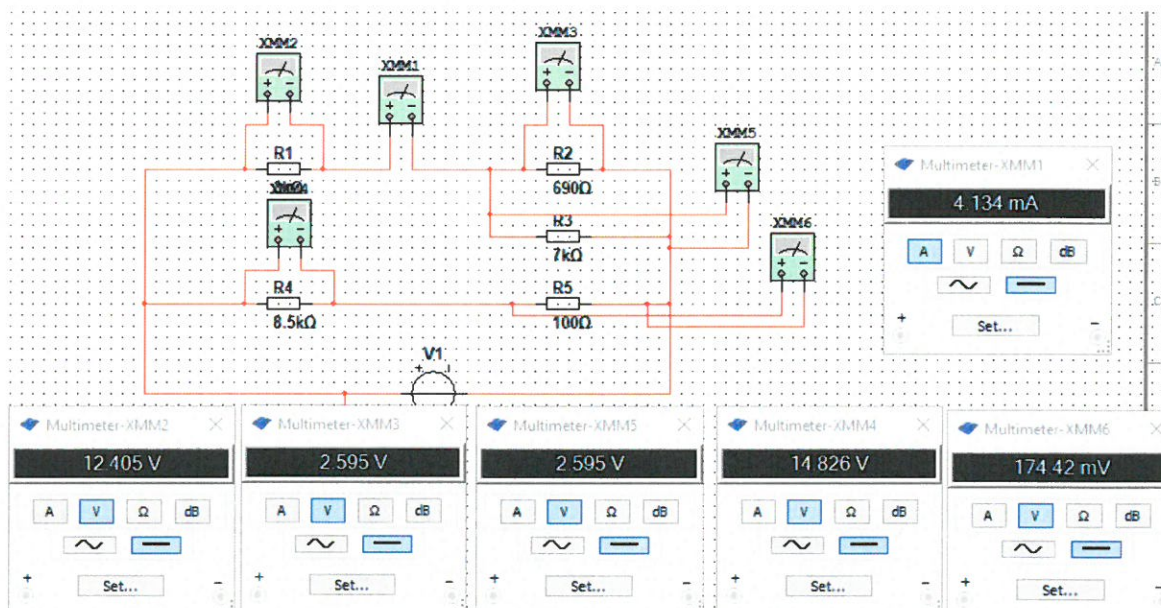
The Voltage across R5 is:
0.1744

```

| Name | Value      |
|------|------------|
| I1   | 0.0017     |
| I2   | 0.0041     |
| R1   | 3000       |
| R123 | 3.6281e+03 |
| R2   | 690        |
| R23  | 628.0884   |
| R3   | 7000       |
| R4   | 8500       |
| R5   | 100        |
| V    | 15         |
| V1   | 12.4032    |
| V2   | 2.5968     |
| V3   | 2.5968     |
| V4   | 14.8256    |
| V5   | 0.1744     |

In order to prove that MATLAB worked, diagram 4 shows different values of resistors that were chosen at random. They were entered in and the program then calculated the new value of voltages.

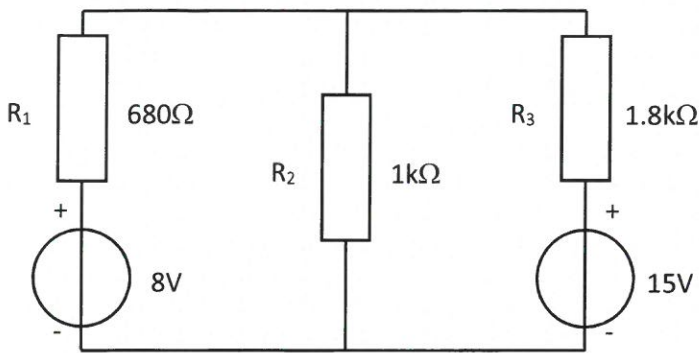
Below shown is diagram 5. This shows multisim with the chosen resistor values. On this diagram the multimeter shows the voltages. As seen the values are very close between both MATLAB and multisim.



For this task it is imperative to remember that multisim dose have a tolerance built into its system. This is to allow the program to show values that would be very close the the values in a practical. No matter what insroments is used in the real world there were always be a tolerance. This is why MATLAB and multisim show a slight difference in values.

*Have not include a copy of the Matlab program.*

## Task 2



$$I_{SC} = \left( \frac{8}{680} \right) + \left( \frac{15}{(1.8 \times 10^3)} \right) = 20.1 \times 10^{-3}$$

$$R = \left( \frac{(680 \times (1.8 \times 10^3))}{(680 + (1.8 \times 10^3))} \right) = 493.55$$

$$I = \frac{493.55}{493.55 + 1000} \times (20.1 \times 10^{-3}) =$$

$$I = 6.64 \text{ mA} \quad \text{or} \quad I = 0.00664 \text{ A}$$

Here is an Diagram showing the circuit that will be used for this task. It is a circuit that can be described as a complex DC circuit. For this task Norton's theorem will be used to calculate the current flowing through  $R_2$ .

Norton's theorem equations will be shown below that are needed to find the current.

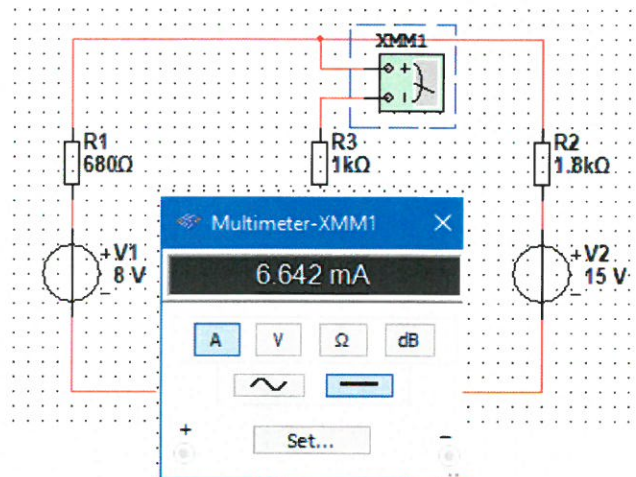


Diagram 7 shows a multisim simulation of the circuit that was provided for this task. The value obtained from the multimeter is to confirm the outcome of the calculation value.

For the other half of this task a MATLAB program needed to be designed to be able to calculate the value of the current through  $R_2$ . Both Thevenin's and Norton's theorem are used in for the MATLAB program. This can be seen in Diagram 8. As part of the task the MATLAB program was adjusted slightly. This was to allow the program to calculate the voltage across each resistor as well as the current flowing through them.

```
%Supply Voltage
V1=input('Enter the voltage V1:');
V2=input('Enter the voltage V2:');
R1=input('Enter the value for R1:');
R2=input('Enter the value for R2:');
R3=input('Enter the value for R3:');

%Calculate Thevenin's Theory
I1 = (V1-V2)/(R1+R3);
V = V1-(I1*R1);
rT=((R1*R3)/(R1+R3));
IT=V/(R2+rT);

%Calculating Current 1 (I1)
%Calculating V4
%Calculating V5

% Calculate Norton's Theory
Isc = (V1/R1)+(V2/R3);
rN = ((R1*R3)/(R1+R3));
IN = (rT/(rT+R2))*Isc;

%Display values
disp('Thevenin's Current:')
disp(IT)
disp('Norton's Current:')
disp(IN)

%Displays message
%Display V1
%Displays message
%Display V2

%Calculate V1, V2 and V3
VR2 = R2*IT;
VR1 = V1 - VR2;
VR3 = V2 - VR2;
IR1 = VR1/R1;
IR3 = VR3/R3;

%Display values
disp('The Current through R1 is:')
disp(IR1)
disp('The Current through R2 is:')
disp(IT)
disp('The Current through R3 is:')
disp(IR3)

%Displays message
%Display I1
%Displays message
%Display I2
%Displays message
% Display IR3

%Display values
disp('The Voltage across R1 is:')
disp(VR1)
disp('The Voltage across R2 is:')
disp(VR2)
disp('The Voltage across R3 is:')
disp(VR3)

%Displays message
%Display VR1
%Displays message
%Display VR2
%Displays message
% Display VR3
```

*Missing the results.*

### Task 3

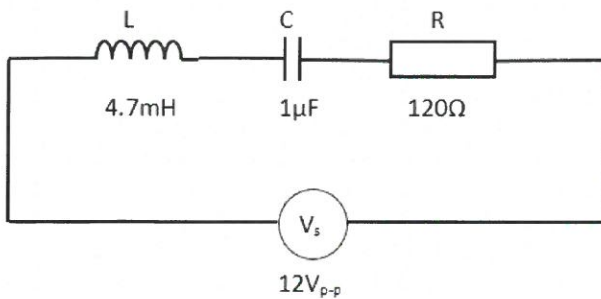


Diagram 9 shows a series AC circuit. As part of this task a 1 kHz phase angle and the resonant frequency was calculated.

Here are the calculations that were needed in order to calculate the phase angle at 1 kHz and resonant frequency.

#### Reactance

$$X_L = 2\pi f l$$

$$X_C = \frac{1}{2\pi f c}$$

#### Impedance

$$Z = \sqrt{R^2 + (x_l - x_c)^2}$$

#### Phase angle

$$\phi = \tan^{-1} \left( \frac{x_l - x_c}{R} \right)$$

$$L = 4.7\text{mH}$$

$$C = 1\mu\text{F}$$

$$R = 120$$

$$X_C = 1/2\pi f c = \frac{1}{2\pi \times 1000 \times (1 \times 10^{-6})} = 159.15 \text{ (at 1 kHz)}$$

units

$$X_L = 2\pi f l = 2 \times \pi \times 1000 \times 4.7 \times 10^{-3} = 29.53 \text{ (at 1 kHz)}$$

#### Resonant Frequency

$$F_0 = \frac{1}{2\pi\sqrt{LC}}$$

$$F_0 = \frac{1}{2\pi\sqrt{(4.7 \times 10^{-3}) \times (1 \times 10^{-6})}} = ?$$

Have not calculated phase angle.

$$\text{RMS to peak to peak RMS} = \frac{V_p}{\sqrt{2}}$$

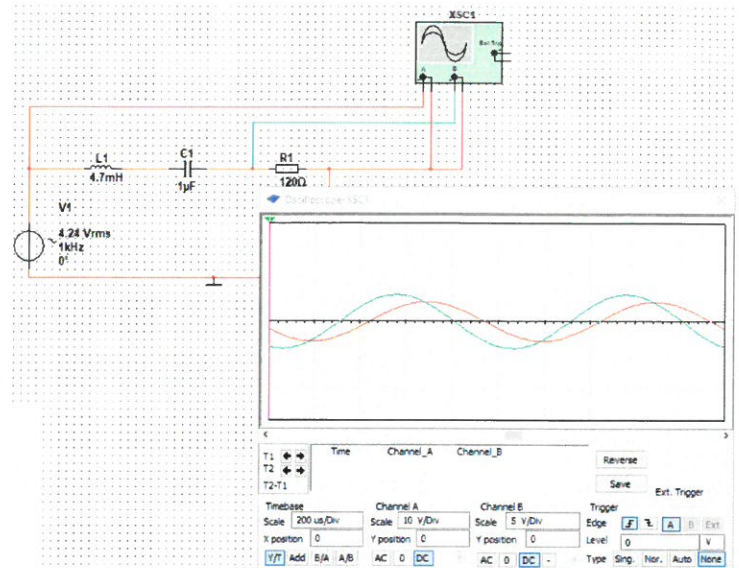
$$t = 120.52\mu\text{s} \quad (120.52 \times 10^{-6})$$

$$\phi = f \times t \times 360^\circ = 1000 \times (120.52 \times 10^{-6}) \times 360 = 43.3872^\circ$$

A simulation was created on multisim after the calculations had been done. Diagram 10 shows the simulation which shows the circuit and an oscilloscope.

Even though the oscilloscope in diagram 10 doesn't show the time value needed. The value that was recorded was 127.91 $\mu$ s.

$$1000 \times (127.91 \times 10^{-6}) \times 360 = 46.05^\circ$$



As well as the Multisim simulation it was necessary to create a MATLAB program that was able to determine the phase angle, resonant frequency and also produce a plot of the waveform showing the phase difference. Diagram 11 shows a screenshot of the code that was created for this task.

```
%inputs
L1 = input ('Enter inductor value:');
C1 = input ('Enter Capacitor value:');
R1 = input ('Enter Resistor value:');
V1 = input ('Enter Supply Voltage value:');
F1 = input ('Enter Frequency value:');
MAXFREQ = input('Enter MAXIMUM frequency value:');
fprintf('\n');

%reactance
XL = 2*pi*F1*L1;
XC = 1/(2*pi*F1*C1);

%Phase Angle
PA = atan((XL-XC)/R1)*(180/pi);

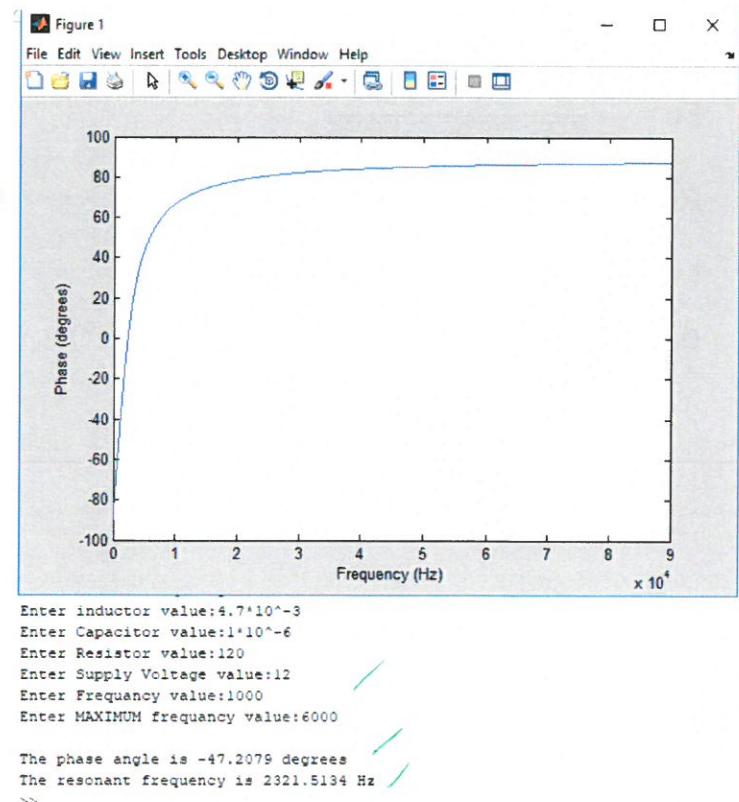
%Resonant Frequency
FO = 1/(2*pi*sqrt(L1*C1));

%Plot Phase angle Loop
for PAL = 1:MAXFREQ
    freq(PAL)=PAL;
    XL = 2*pi*freq(PAL)*L1;
    XC = 1/(2*pi*freq(PAL)*C1);
    CPA(PAL) = atan((XL-XC)/R1)*(180/pi);
end;

%Display Values

X1 = ['The phase angle is ',num2str(PA),' degrees'];
disp(X1)
X2 = ['The resonant frequency is ',num2str(FO),' Hz'];
disp(X2)
plot(freq,CPA,'b-');
xlabel('Frequency (Hz)');
ylabel('Phase (degrees)');
```

Diagram 12 shows the results from MATLAB program. It shows the phase angle value also the resonant frequency value. On top of that it does show a graph showing the relation between phase angle and resonant frequency.

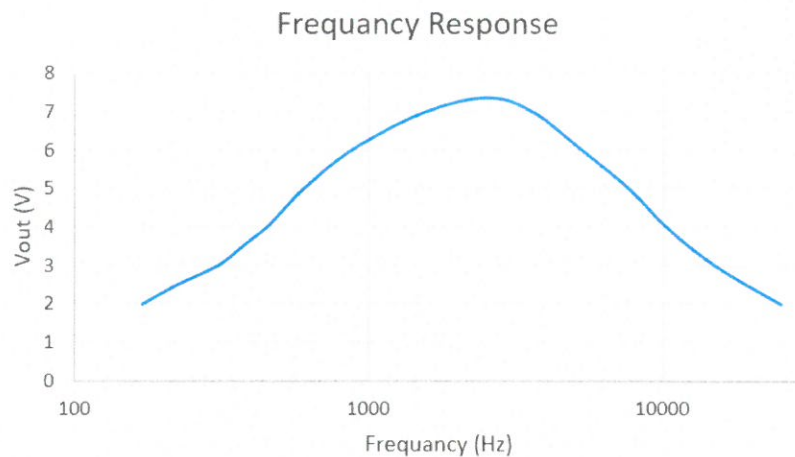


After that a circuit was constructed onto a bread bored to be able to take a recording of the values obtained from the oscilloscope. Appendix 1 shows images from the practical as well as the screen of the oscilloscope. Diagram 13 shows the table of results obtained from the practical after changing the voltage input. And graph was produce to show how the results change.

With the practical the value for the time difference was taken from the oscilloscope. This value was recorded as  $104\mu\text{F}$ . By using the time difference value it was possible to calculate the phase difference. This was done by doing the following:

$$1000 \times (104 \times 10^{-6}) \times 360 = 37.44^\circ$$

| Frequency (Hz) | Vout (V) |
|----------------|----------|
| 170            | 2        |
| 223.2          | 2.5      |
| 307.3          | 3        |
| 371.54         | 3.5      |
| 450            | 4        |
| 518.43         | 4.5      |
| 600            | 5        |
| 870            | 6        |
| 1550           | 7        |
| 2530           | 7.37     |
| 3600           | 7        |
| 5300           | 6        |
| 7680           | 5        |
| 10290          | 4        |
| 14980          | 3        |
| 25100          | 2        |



Resenent frequency 2530 Hz

The resonant frequency was recorded from the graph as well as comparing with the table. When the practical came to read 7.5 volts, it was impossible to reach. Due to this the highest frequency that could be recorded was 2530Hz which results in being the resonant frequency.

*Have not compared the results.*

#### Task 4

This task is based on a complex AC circuit. Below shows the mesh theorem calculations to be able to calculate the current through the circuit.

$$XL = 2\pi fL = 2 \times \pi \times 1000 \times 1.2 \times 10^{-3} = j7.5398\Omega$$

$$XC = \frac{1}{2\pi fC} = \frac{1}{2 \times \pi \times 1000 \times 33 \times 10^{-6}} = j4.8229\Omega$$

Loop 1

$$V = (R1 \times I1) + XC (I1 - I2)$$

$$10 = (22 \times I1) + (-j4.8229)(I1 - I2)$$

$$10 = (22 - j4.8229)I1 + (j4.8229)I2 \quad (1)$$

Loop 2

$$0 = (R2 \times I2) + (XL \times I2) + XC (I2 - I1)$$

$$0 = (39)I2 + (j7.5398)I2 + (-j4.8229) \times (I2 - I1)$$

$$0 = (-j4.8229)I1 + (39 + j2.7169)I2 \quad (2)$$

Rearrange equation (2)

$$(j4.8229)I1 = -(39 + j2.7169)I2$$

$$I1 = \frac{-(39 + j2.7169)I2}{j4.8229} \quad (3)$$

Substituting the value of I1 into equation (1)

$$10 = \frac{-(22 - j4.8229)(39 + j2.7169)I2}{j4.8229} + (j4.8229)I2$$

$$10 = j0.2073(22 - j4.8229)(39 + j2.7169)I2 + (j4.8229)I2$$

$$10 = j0.2073(871.1 - j128.32)I2 + (j4.8229)I2$$

$$10 = (j180.58 + 26.6)I2 + (j4.8229)I2$$

$$I2 = \frac{10}{j185.4029 + 26.6} = 0.0076 - j0.0528$$

Substituting the value of I2 into equation (3)

$$I1 = \frac{-(39 + j2.7169)(0.0076 - j0.0528)}{j4.8229} = \frac{-(0.4399 + j2.0386)}{j4.8229}$$

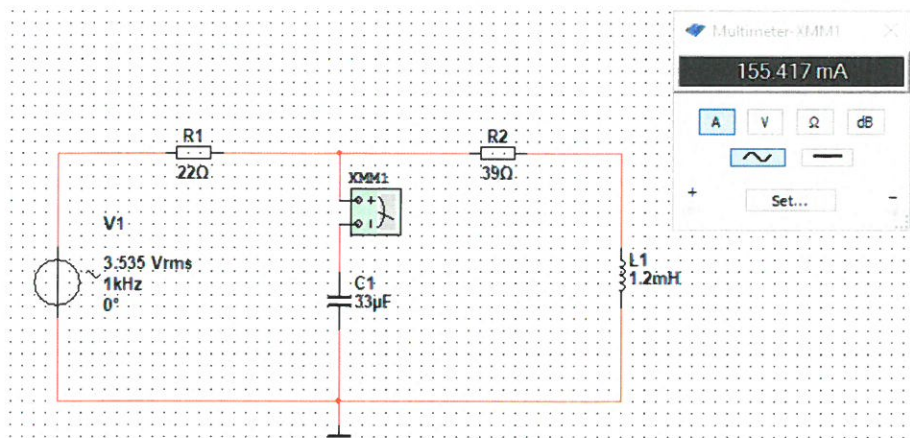
$$I1 = 0.4227 + j0.0912$$

Then

$$I = I1 - I2 = (0.4227 + j0.0912) - (0.0076 - j0.0528) = 0.4141 + j0.1440 = 0.438 \angle 19.175^\circ$$

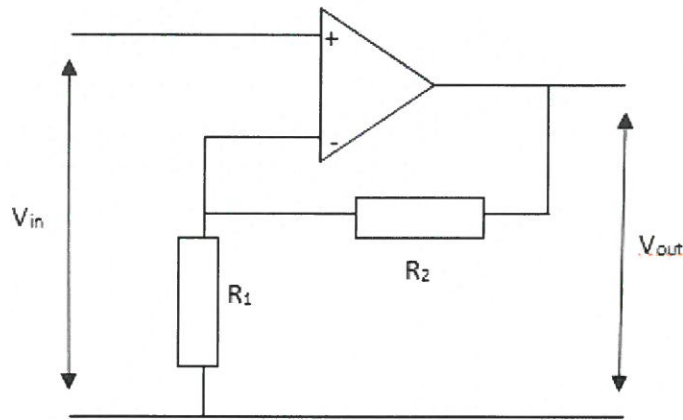
$$I_{rms} = \frac{0.438}{2 \times \sqrt{2}} = 154.86 \text{ mA}$$

*Well done.*



Here is a simulation that was created to confirm the value of the current that was calculated. The values are not exactly the same. But they are very close

## Task 5



Here is a diagram showing a non-inverting amplifier.

Below shows the calculation made to obtain  $R_{in}$  and  $R_f$  when there is a gain of 200. For this task a resistor value was required to be chosen. The chosen resistor value was  $6.8k\Omega$  for  $R_1$ .

$$A_v = 1 + \frac{R_2}{R_1}$$

$$R_2 = R_1 (A_v - 1)$$

$$R_2 = (199) \times (6.8 \times 10^3)$$

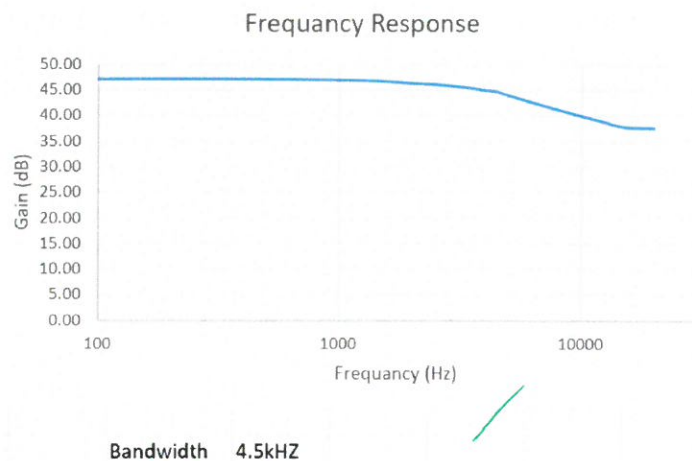
$$R_2 = 1353200 \quad \text{OR } 1.3532M\Omega$$

$$\text{Let } R_2 = 1.5M\Omega$$

$R_2$  was made to be  $1.5M\Omega$  due to that is the closest resistor value available in the stores.

After calculation the value of the resistors they were used in a practical for a non-inverting amplifier. The circuit used a 741 op amp that was constructed on breadboard. Appendix 1 shows images of the practical that took place.

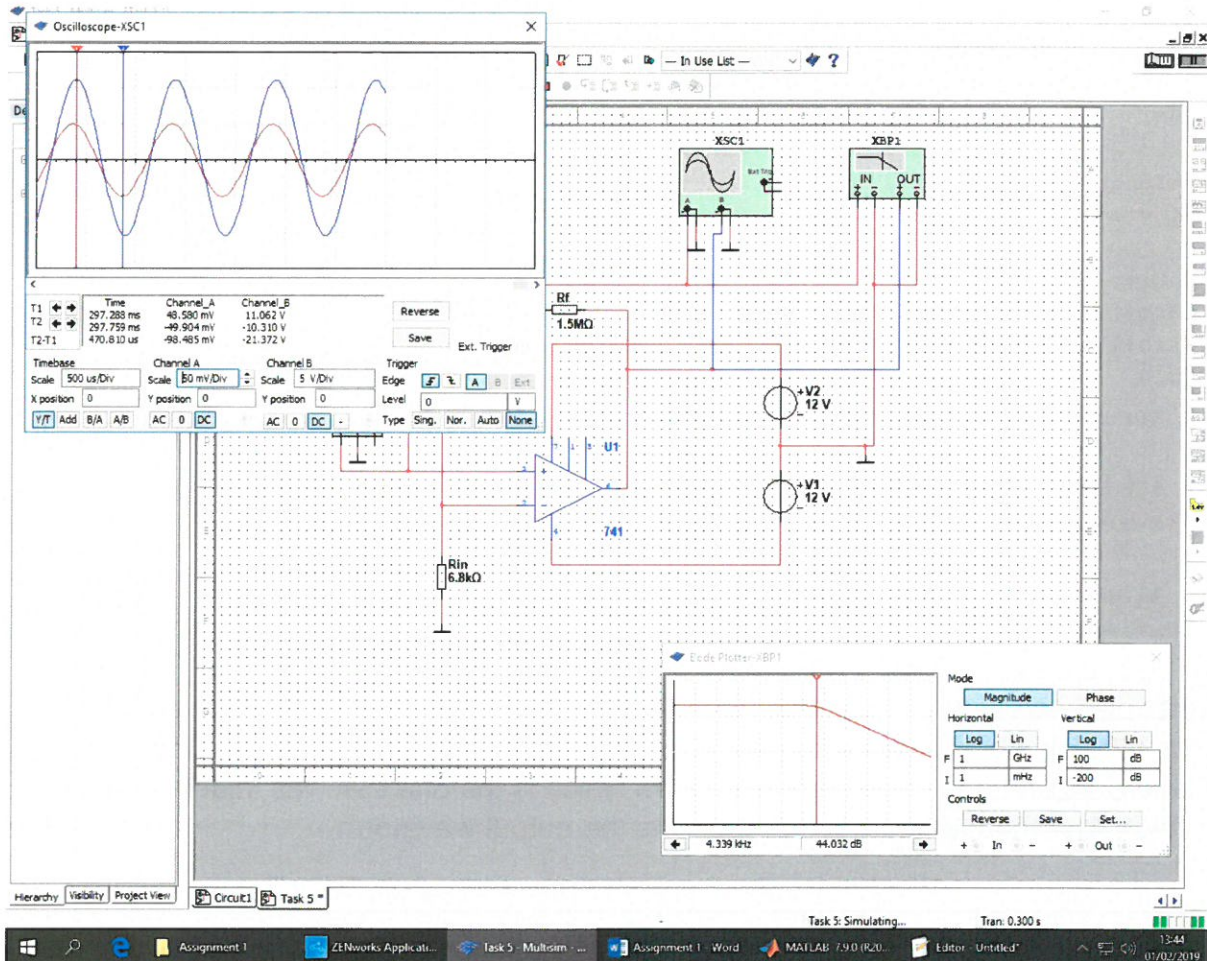
| Frequency (Hz) | Vout (V) | Gain   | Gain (dB) |
|----------------|----------|--------|-----------|
| 100            | 23.96    | 224.09 | 47.01     |
| 500            | 23.96    | 224.09 | 47.01     |
| 1000           | 23.56    | 220.35 | 46.86     |
| 1500           | 22.97    | 214.83 | 46.64     |
| 2000           | 21.98    | 205.57 | 46.26     |
| 2500           | 21.38    | 199.96 | 46.02     |
| 3000           | 20.59    | 192.57 | 45.69     |
| 3500           | 19.8     | 185.19 | 45.35     |
| 4000           | 18.81    | 175.93 | 44.91     |
| 4500           | 18.22    | 170.41 | 44.63     |
| 5000           | 16.83    | 157.41 | 43.94     |
| 8000           | 12.24    | 114.48 | 41.17     |
| 12000          | 9.5      | 88.85  | 38.97     |
| 15000          | 8.32     | 77.82  | 37.82     |
| 20000          | 8.12     | 75.94  | 37.61     |



$V_{in}$  was recorded at 0.10692 and  $V_{out}$  was recorded as 22.77. These were used to calculate the gain which was recorded as 212.963. The table and the graph above are the results that were provided and calculated from the practical. For the gain in the table to be calculated it used  $V_{in}$  and the corresponding  $V_{out}$  that was recorded at each frequency. The gain (dB) was calculated by  $20\log$  multiplied by the  $V_{out}$  that corresponding frequency. The bandwidth was recorded as 4.5kHz which is shown at the bottom of the graph.

Here is the screenshot of multisim and the result obtained from it. As shown in the screenshot below is the resonant frequency is 4.339kHz. When comparing to the practical and the simulation the results of the resonant frequency is very close in value.

*Bandwidth*



*what about gain*

## Task 6

```
% Parameters
R1 = 200; C = 0.0000015;
f = 200;

% Time vector
t = 0:0.00005:0.01;

% Output
for s = 1:length(t)
    Vo(s) = -1/(R1*C)*quad('Vin',0,t(s));
end;

% Input
Vi = 1*sign(sin(2*pi*f*t));

% Display results
plot(t,Vi,'r-',t, Vo,'b-');
xlabel('Time (sec)'); ylabel('Output and Input');
grid

% Properties

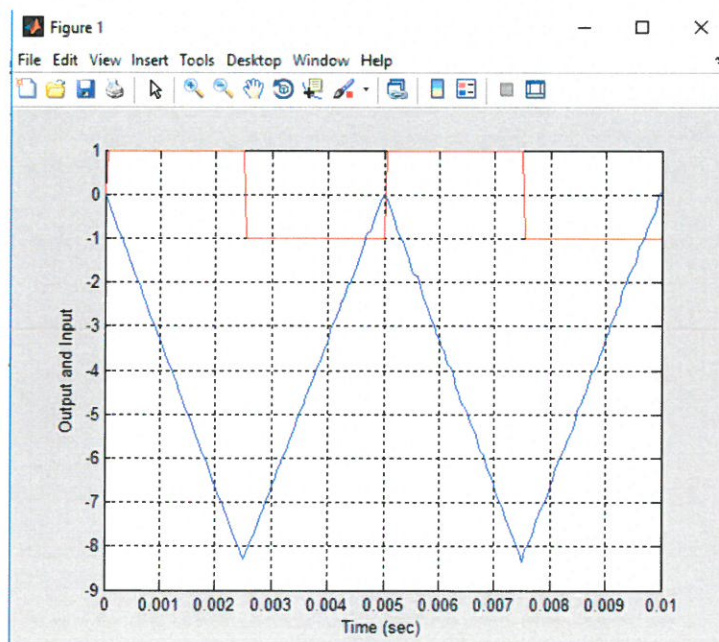
% Calculate a function value at point x
function[V] = Vin(x)

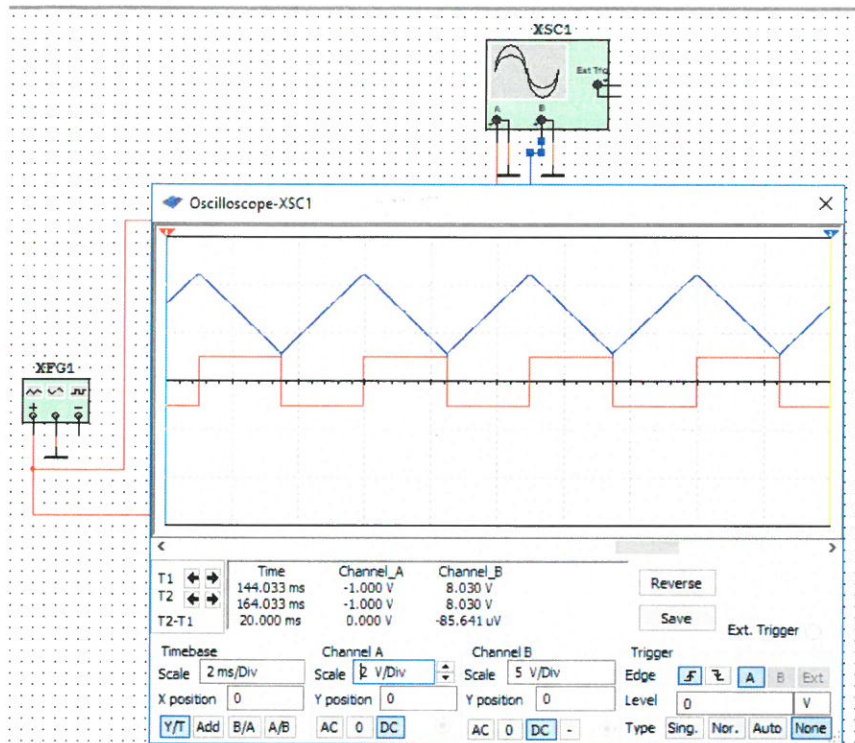
% The function expression
V = 1*sign(sin(2*pi*200*x));
```

For this task a MATLAB program was developed that would calculate the waveform output when a square waveform is injected. The MATLAB program is presented below.

As well as the program another sub program was also created that was used.

After calculating the values that were selected to be inserted into the program. The graph below shows the output that was created. As shown in the graph there are two waveforms. One is the square waveform which is the one that was injected into the circuit. And the triangle waveform shows the output waveform.



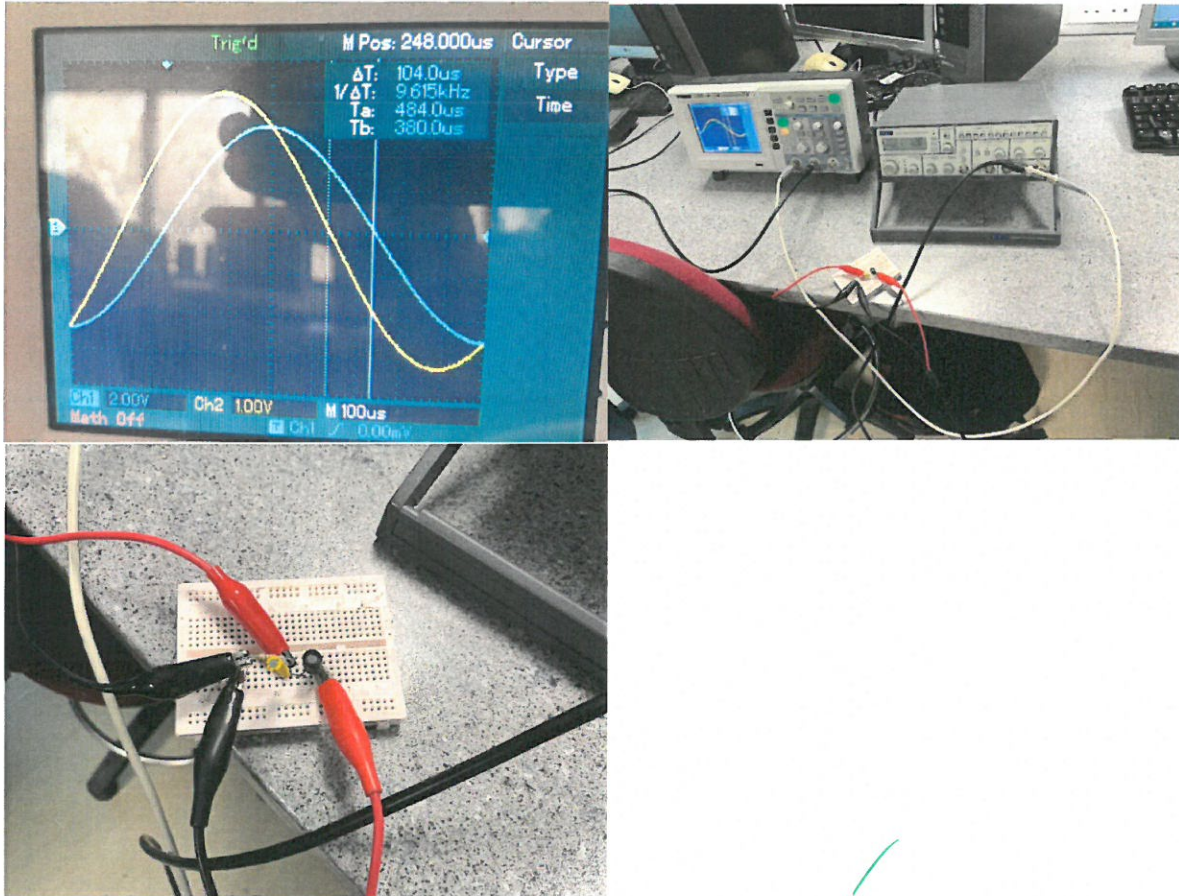


Here is a screenshot of the simulation that was produced on multisim. This was to compare the results of the outcome.

When inspecting both the MATLAB and multisim output, they both produce a similar outcome. This proves both the programs works.

## Appendix

### Appendix 1



Have covered all the elements of the tasks and your comments in places were very weak or non-existent.

You need to be more careful with your presentation, especially your spelling.