

LEVEL 5 ASSESSMENT SPECIFICATION

Student name:	George Bellmaine	Student ID number:	
Programme:	HND/HNC Electrical/Electronic Engineering, HNC Instrumentation Engineering & HNC Power System Engineering		
Module:	Electrical Principles, Methods and Simulation		
Module code:	PSDE5009	Contribution to Overall Module Assessment (%):	50%
Lecturer:	Jason Pointer	Internal Verifier:	Steve Roberts
Assignment Title:	Analogue Systems	Word count (or equivalent):	2000
Submission deadline:	07/02/19	Return date of provisional marks & written feedback:	
Submission method:	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.) Alternative submission method (if applicable): Late submission of the assessment will result in a late penalty mark. 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.		
Academic honesty / referencing:	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.		

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
1. Engagement with Literature Skills	0	0
2. Knowledge and Understanding Skills	20	11.1
Achieved 55% for Task 1. Achieved 42% for Task 2. Achieved 35% for Task 3. Achieved 85% for Task 4. Achieved 60% for Task 5. Knowledge is reasonably detailed and accurate in most parts. Show a good understanding of some concepts and principles covered by this assignment but not all of the elements were covered for some of the tasks.		
3. Cognitive and Intellectual Skills	20	1.7
Achieved 15% for Task 1. Achieved 10% for Task 3. Achieved 0% for Task 5. 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.		
4. Practical Application Skills	50	27.5
Achieved 50% for Task 1. Achieved 30% for Task 2. Achieved 45% for Task 3. Achieved 70% for Task 4. Achieved 50% for Task 5. Achieved 85% for Task 6. A good and appropriate application of established methods in the use of Matlab, Multisim and practical work but in places not all of the required work was produced.		
5. Transferable Skills for Life and Professional Practice	10	3.5
The assessment was mostly ordered in its presentation in which relevant concepts are reasonably expressed. The work did lack coherence in places, must state the requirements of all tasks.		

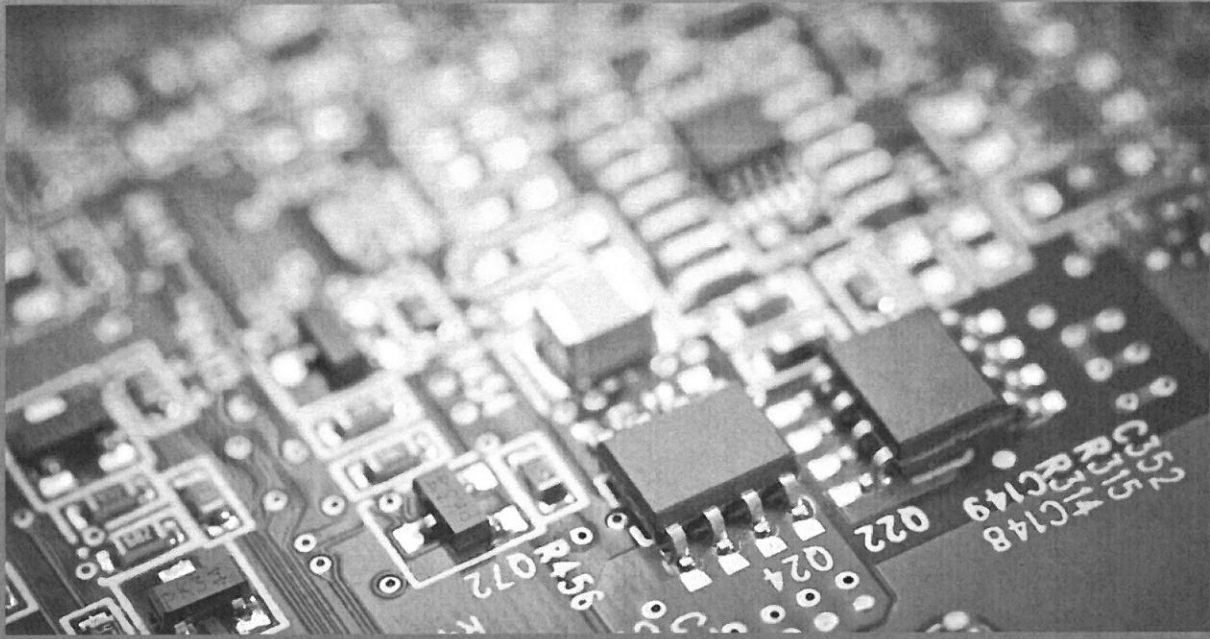
Assessment Mark (Assessment marks are subject to ratification at the Exam Board. These comments and marks are to give feedback on module work and are for guidance only until they are confirmed.)

Late Submission Penalties (tick if appropriate)

Up to 1 week late (40% Max)

Over 1 week late (0%)

44%



ASSIGNMENT 1

ELECTRICAL PRINCIPLES, METHODS AND SIMULATION

HNC - INSTRUMENTATION AND CONTROL, YEAR 2
GEORGE BELLMAINE

TASK 1

a) The measured voltage across each resistor is, $R_1 = 7.37 \text{ V}$

$$R_2 = 2.65 \text{ V}$$

$$R_3 = 2.65 \text{ V}$$

$$R_4 = 2.37 \text{ V}$$

$$R_5 = 7.66 \text{ V}$$

b) $I_1 = V/(R_4 + R_5) = 10/(680 + 2200) = 3.47 \text{ mA}$

$$V_4 = 3.47 * 680 = 2.36 \text{ V}$$

$$V_5 = 3.47 * 2200 = 7.63 \text{ V}$$

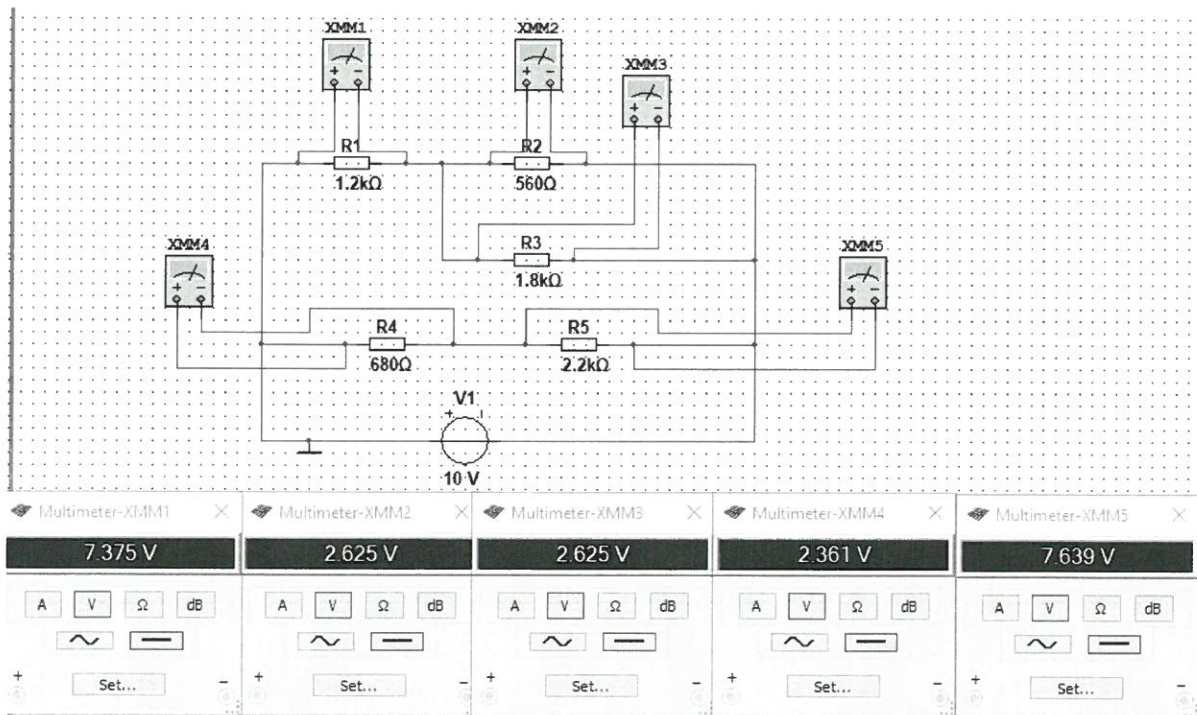
$$R_T = R_2 * R_3 / (R_2 + R_3) = 560 * 1800 / (560 + 1800) = 427.12 \Omega$$

$$I_2 = V / (R_1 + R_T) = 10 / (1200 + 427.12) = 6.14 \text{ mA}$$

$$V_1 = 6.14 * 1200 = 7.36 \text{ V}$$

$$V_{2/3} = 6.14 * 427.12 = 2.62 \text{ V}$$

c) The print screen below shows the actual voltages which are the same as the calculated ones this proves that the calculations are correct.



- d) The print screen below shows the MATLAB program I built to calculate the values of the resistors in the circuit, which are the same as the ones above.

```

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Enter The Supply Voltage10
Enter The Value of R11200
Enter The Value of R2560
Enter The Value of R31800
Enter The Value of R4680
Enter The Value of R52200
The Voltage Across R1 Is:
    7.3750

The Voltage Across R2/R3 Are The Same:
    2.6250

The Voltage Across R4 Is:
    2.3611

The Voltage Across R5 Is:
    7.6389

```

To prove that the MATLAB program works correctly I used different values.

```

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Enter The Supply Voltage10
Enter The Value of R1450
Enter The Value of R21000
Enter The Value of R31600
Enter The Value of R4700
Enter The Value of R52400
The Voltage Across R1 Is:
    4.2238

The Voltage Across R2/R3 Are The Same:
    5.7762

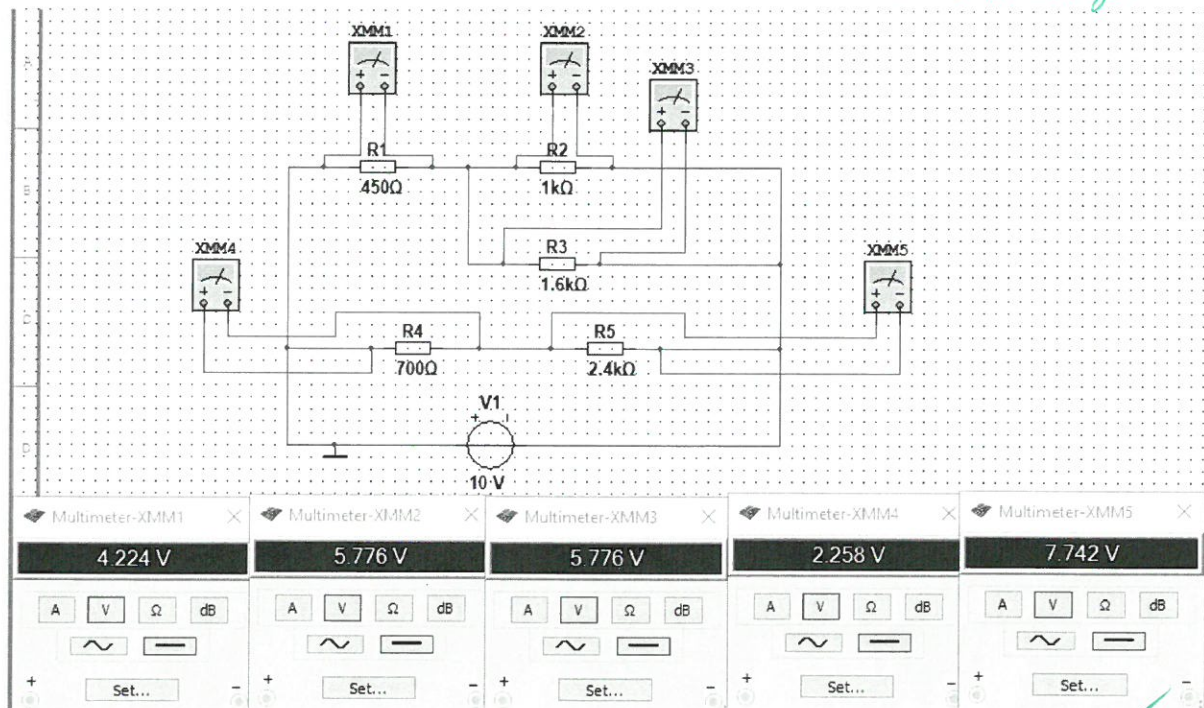
The Voltage Across R4 Is:
    2.2581

The Voltage Across R5 Is:
    7.7419

```

What this print screen shows is how accurate MATLAB is compared to multisim because the results on this are rounded up/down.

There other things to consider.

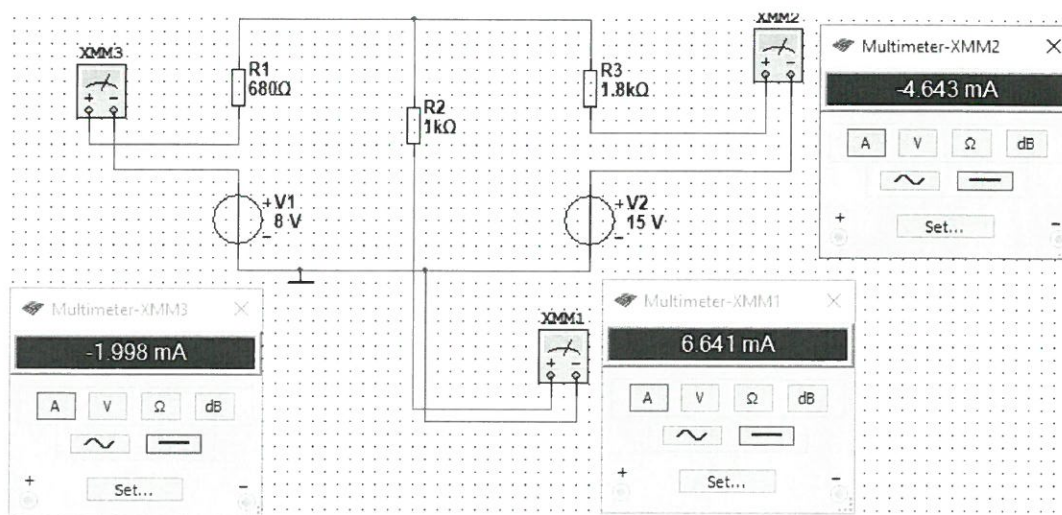


TASK 2

- a) $I_1 = (V_1 - V_2) / (R_1 + R_3) = (8 - 15) / (680 + 1800) = 0.00282...$
 $E = V_1 - I_1 \cdot R_1 = 8 - 0.00282... \cdot 680 = 9.9193... V$
 $r = (R_1 \cdot R_3) / (R_1 + R_3) = (680 \cdot 1800) / (680 + 1800) = 493.548387...$
 $I = E / (r + R_2) = 9.9193... / (493.548387... + 1000) = 6.641431966 \times 10^{-3} mA$

Should state the method and steps.

I answered them like this as accurately as possible but the numbers were too big to write down.



This shows all the current although some of the polarity is the wrong way round.

b)

```

This is a Classroom License for instructional use only.
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Enter The Supply Voltage 18
Enter The Supply Voltage 215
Enter The Value of R1680
Enter The Value of R21000
Enter The Value of R31800
Thevanins Voltage:
    9.9194

The Resistance After Removing E.M.F:
    493.5484

The current through R2 is:
    0.0066
    
```

This print screen shows how the MATLAB shortens the numbers yet still gives an accurate answer. R2 is also answered in AMPS whereas in my calculations it is in MILLIAMPS.

```

This is a Classroom License for instructional use only.
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Enter The Supply Voltage 18
Enter The Supply Voltage 215
Enter The Value of R1680
Enter The Value of R21000
Enter The Value of R31800
Thevanins Voltage:
    9.9194

The Resistance After Removing E.M.F 1:
    642.8571

The Resistance After Removing E.M.F 2:
    493.5484

The Resistance After Removing E.M.F 3:
    404.7619

The current through R1 is:
    0.0075 ✗

The current through R2 is: ✓
    0.0066

The current through R3 is:
    0.0045 ✗
    
```

Answers are incorrect

This shows the current flow through all the resistors but shown in AMPS not MILLIAMPS.

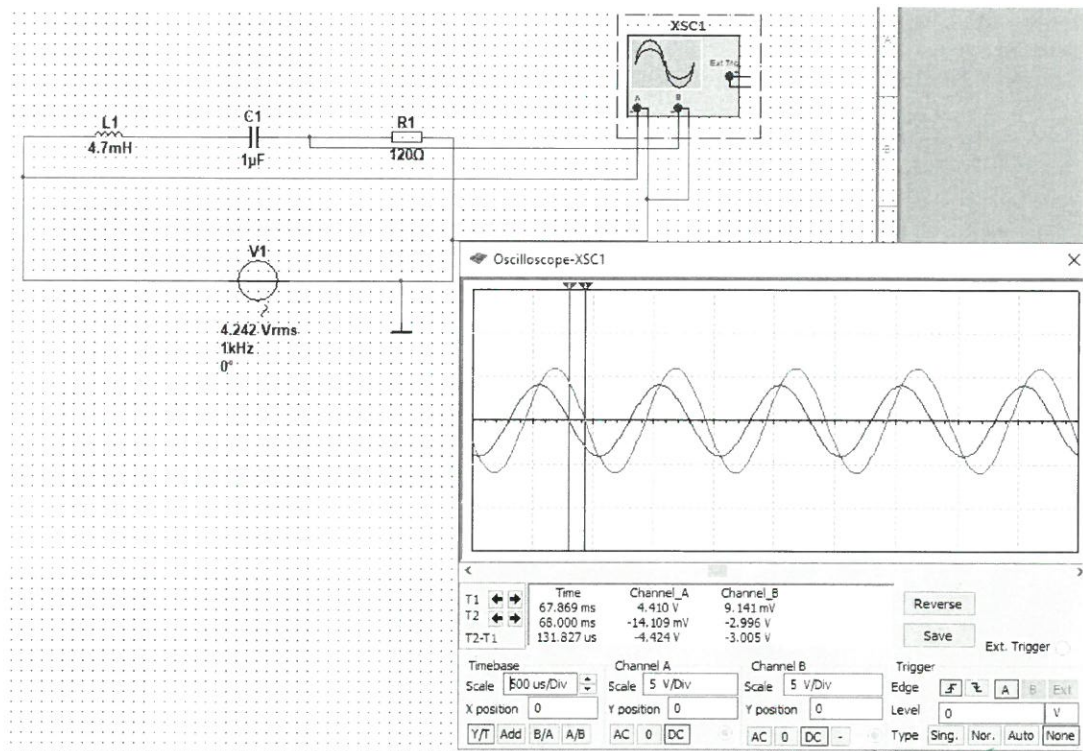
Your program is missing, I have seen it run in the classroom.

TASK 3

a. $F_0 = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{4.7 \times 10^{-3} \times 1 \times 10^{-6}}} = 2.321 \text{ kHz}$ ✓

Calculation of phase angle.

b.



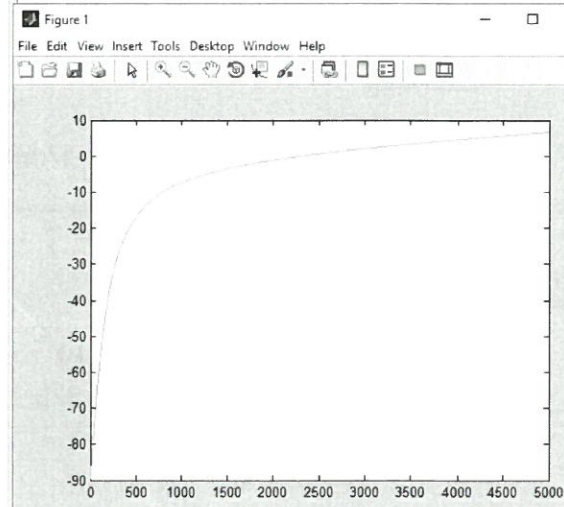
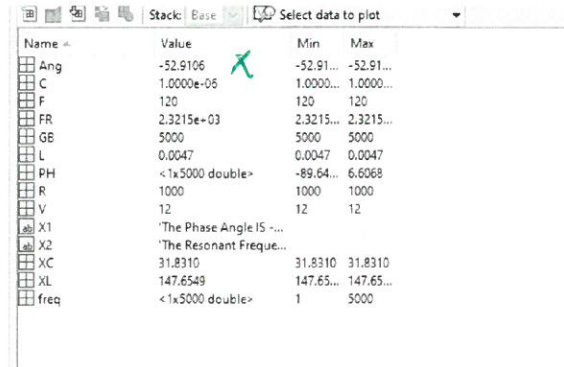
Have not determined the phase angle.

What about resonant.

c. The photo below shows my MatLab program working and creating the phase angle.

```
This is a Classroom License for instructional use only.
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Enter The Inductor Value .0047
Enter The Amplitude of Supply Voltage 12
Enter The Capacitor Value .000001
Enter The Resistor Value 120
Enter The Frequency of Supply Voltage 1000

The Phase Angle IS -52.9106Degrees
The Resonant Frequency Is 2321.5134Hz
>>
```



```
%George Bellmaine ASE 1 TASK 3%

%INPUTS
L=input ('Enter The Inductor Value ');
V=input ('Enter The Amplitude of Supply Voltage ');
C=input ('Enter The Capacitor Value ');
F=input ('Enter The Resistor Value ');
R=input ('Enter The Frequency of Supply Voltage ');
fprintf('\n')

%REACTANCE CALCULATION
XL=2*pi*F*L;
XC=1/(2*pi*F*C);

%PHASE ANGLE
Ang=(180/pi)*atan((XL-XC)/R);

%RESONANT FREQUENCY
FR=1/(2*pi*sqrt(L*C));

%FOR LOOP THE PHASE ANGLE
for GB=1:5000
    freq(GB)=GB; %VARIABLE FREQUANC
    XL=2*pi*freq(GB)*L;
    XC=1/(2*pi*freq(GB)*C);
    PH(GB)=(180/pi)*atan((XL-XC)/R);
end

X1=['The Phase Angle IS ',num2str(Ang),'Degrees'];
disp(X1)

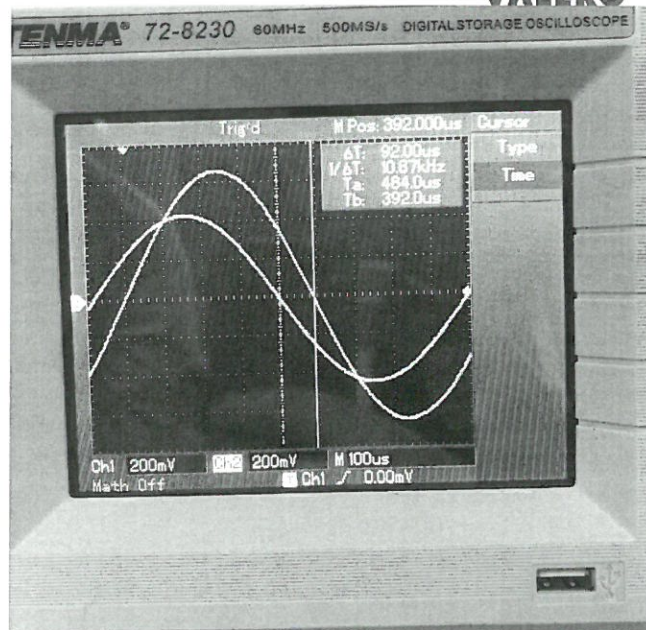
X2=['The Resonant Frequency Is ',num2str(FR),'Hz'];
disp(X2)

plot(freq,PH,'b');

```

This is a print screen of the code I used when designing my MatLab program.

- d. I constructed a circuit on breadboard so I was able to compare these with my simulation results. The photo below shows the waveform on an oscilloscope, which is very similar to my simulated results shown in (task 3 part b). The timing comparison between the actual results and the simulated results are very similar.



Task 4

- a. $X_L = 2\pi fL = 2\pi \times 1000 \times 1.2 \times 10^{-3} = j7.53\Omega$
 $X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi \times 1000 \times 33 \times 10^{-6}} = -j4.82\Omega$

Loop 1

$$\begin{aligned} V &= R_1 I_1 + X_C (I_1 - I_2) \\ 10 &= 22I_1 + (-j4.82) (I_1 - I_2) \\ 10 &= (22 - j4.82) I_1 + j4.82I_2 \end{aligned} \quad (1)$$

Loop 2

$$\begin{aligned} 0 &= R_2 I_2 + X_L I_2 + X_C (I_2 - I_1) \\ 0 &= 39I_2 + j7.53I_2 + (-j4.82) (I_2 - I_1) \\ 0 &= j4.82I_1 + (39 + j2.71) I_2 \end{aligned} \quad (2)$$

$j7.53 - j4.82 = 2.71$

Rearrange eq (2)

$$\begin{aligned} j4.82I_1 &= -(39 + j2.71) I_2 \\ I_1 &= \frac{-(39 + j2.71)I_2}{j4.82} \end{aligned} \quad (3)$$

Substituting the value of I_1 into eq (1).

$$\begin{aligned} 10 &= \frac{-(22 - j4.82)(39 + j2.71)I_2}{j4.82} + j4.82I_2 \\ 10 &= j0.207 (22 - j4.82) (39 + j2.71) I_2 + j4.82 I_2 \\ 10 &= j0.207 (807.06 - j128.36) I_2 + j4.82 I_2 \\ 10 &= (26.57 + j180.31) I_2 + j4.82 I_2 \end{aligned}$$

$$I_2 = \frac{10}{26.57 + j185.13} = 0.0076 - j0.0529$$

Substituting the value of I_2 into eq (3).

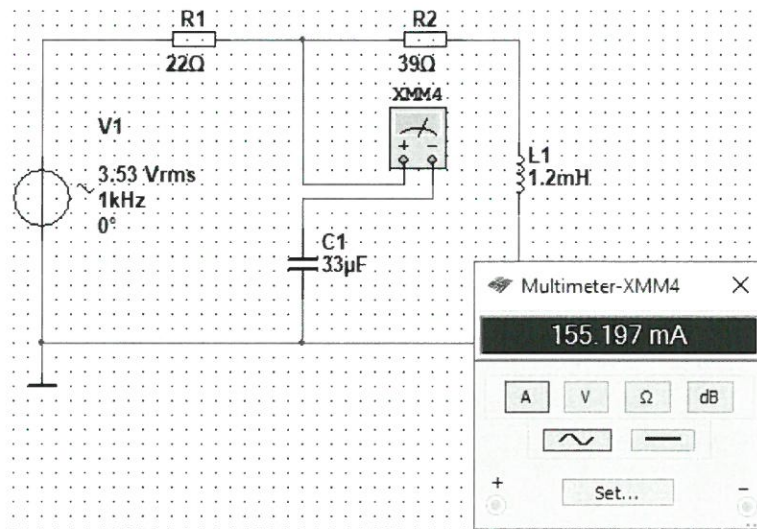
$$I_1 = \frac{-(39 + j2.72)(0.0076 - j0.0529)}{j4.82} = 0.4237 + j0.0913$$

The $I = I_1 - I_2 = 0.4723 + j0.0913 - 0.0076 + j0.0529 = 0.4161 + j0.1442 = 0.44037 \angle 19.1138^\circ \text{A}$

This is the peak-to-peak value for current, $I_{\text{rms}} = \frac{0.44037}{2 \times \sqrt{2}} = 0.1557 \angle 19.1138^\circ \text{A} = 155.7 \text{mA}$

b.

The print screen bellow shows the current through C.



well done

Task 5

a.

Gain 200 $A_v = 200$

non inverting

$$A_v = 1 + \frac{R_F}{R_{in}}$$

$$\Rightarrow \frac{R_F}{R_{in}} = A_v - 1 \Rightarrow R_F = (A_v - 1) \times R_{in}$$

$$R_F = (200 - 1) \times R_{in} = 199 \times R_{in}$$

let $R_{in} = 2.2k\Omega$ so $R_F = 199 \times 2.2 = 437.8k\Omega$

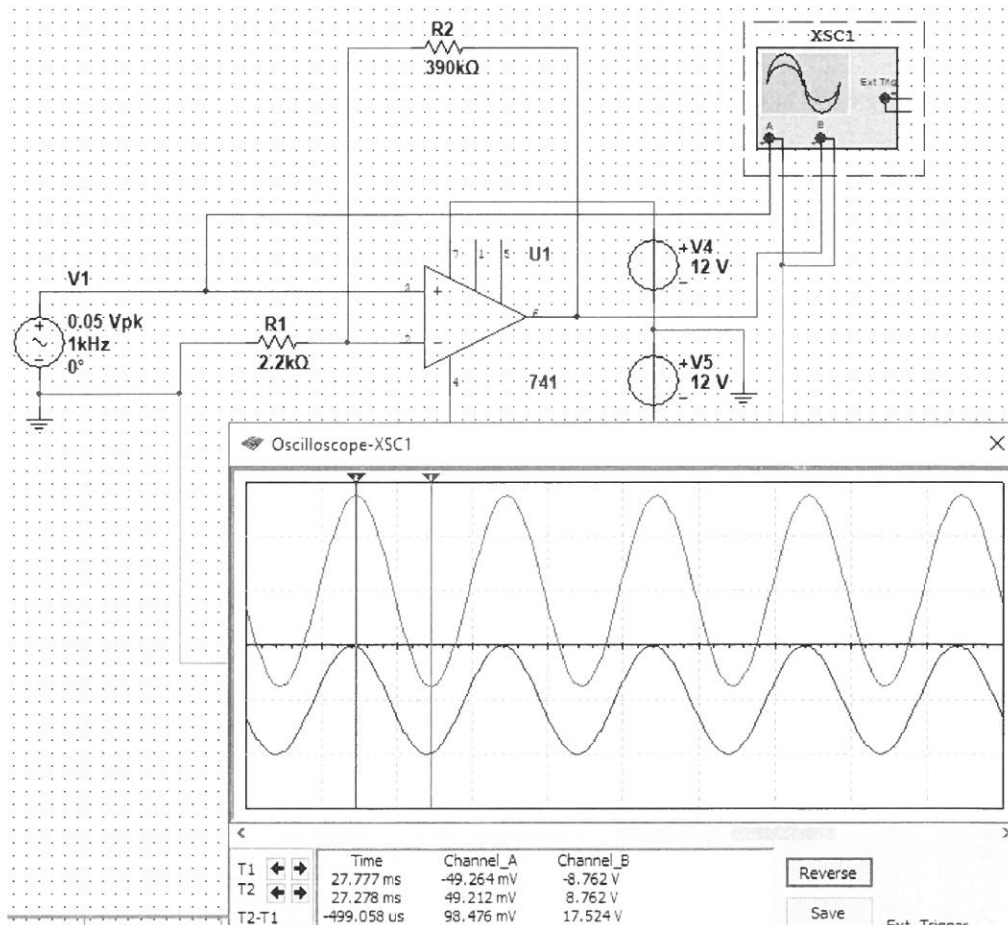
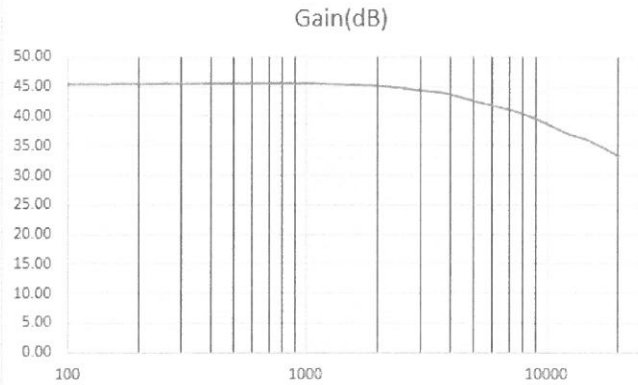
I can use ~~390k~~
390k Ω

b. I made the circuit using a breadboard, took some results, and pointed this in a graph.

you could have typed this up.

frequency (Hz)	Vout(V)	Gain	Gain(dB)
100	18.6	186	45.39
500	18.8	188	45.48
1000	18.8	188	45.48
1500	18.4	184	45.30
2000	18	180	45.11
2500	17.2	172	44.71
3000	16.4	164	44.30
3500	16	160	44.08
4000	15.2	152	43.64
4500	14.2	142	43.05
5000	13.4	134	42.54
8000	10.4	104	40.34
12000	7.2	72	37.15
15000	6.2	62	35.85
20000	4.6	46	33.26

bandwidth = 5000



This print screen shows how the frequency at 1000Hz voltage out is 17.524 and the measured is 18, which is very similar.

No completed.

Task 6

a. %George Bellmaine
%Task 6

% Parameters
R1 =200; C=0.0000015;

% Time vector
t = 0:0.00001:0.01;

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

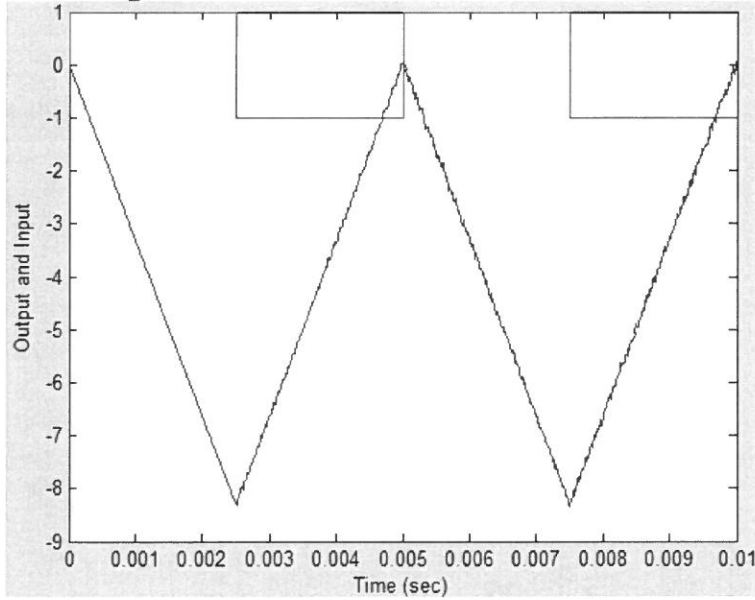
% Input Signal
Vi = 1*sign(sin(2*pi*200*t));

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

%Calculate a function value at point x

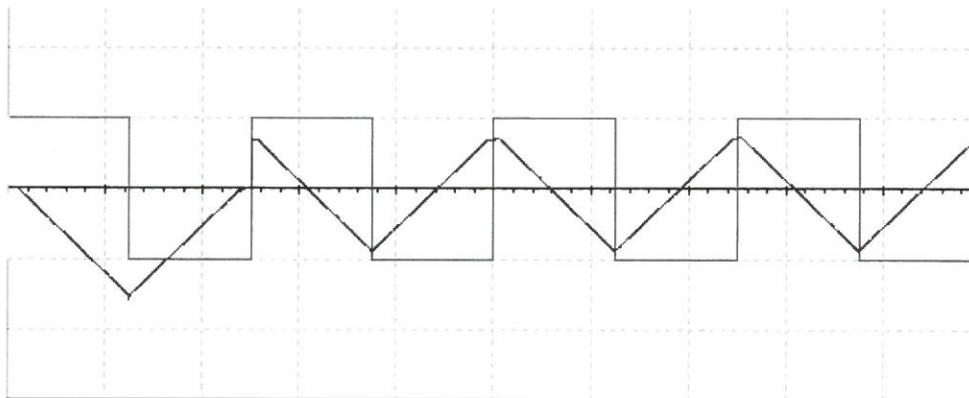
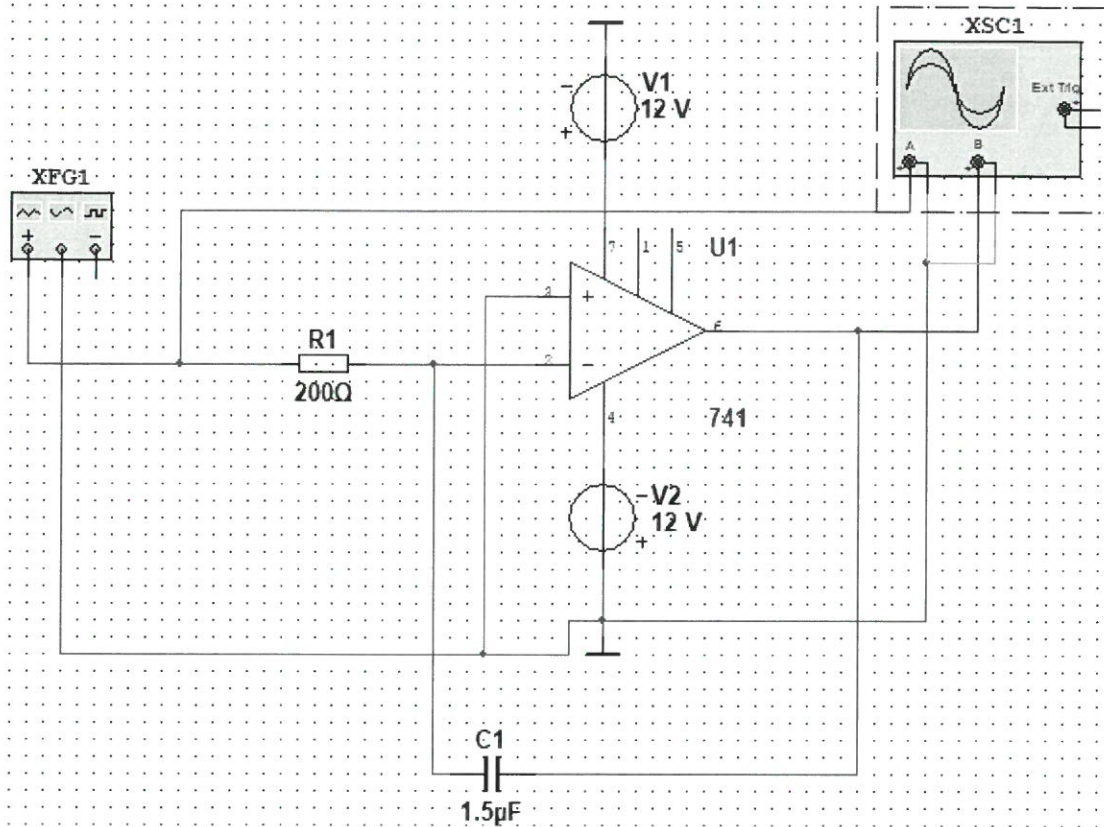
function[V] = Vin(x)

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



This is the coding that I used to create the waveform shown to the left. It uses two programs, which work, together by first using the generic code. Then using a separate code editor to work out V_{in} , which uses a different equation to work with the general code, which shows the two waveforms.

b.



The waveform on multisim matches the waveform on MatLab, which shows square, and triangle waveforms on the same output. The way this is done on multisim is by using a function generator on a non-inverting amplifier circuit.

There are a number of tasks that are not completed, must take more care and read the task fully.

You need to take more care with the presentation of the work.