

MARKING CRITERIA AND STUDENT FEEDBACK

This section details the assessment criteria. The *extent* to which these are demonstrated by you determines your mark. The marks available for each criterion 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.

Common Assessment Criteria Applied	Marks available	Marks awarded
1. Research-informed literature Extent of research and/or own reading; selection of credible sources; application of appropriate referencing conventions.	10	
Inclusion of a wide range of relevant literature independently selected		6.9
2. Knowledge and Understanding of Subject Extent of knowledge and understanding of concepts and underlying principles associated with the discipline.	20	
You showed excellent knowledge throughout and understood the concepts and key themes		18
3. Analysis Analysis, evaluation and synthesis; logic, argument and judgement; analytical reflection; organisation of ideas and evidence.	20	
Through logical work supported by calculation.		17
4. Practical Application and Deployment Deployment of methods, materials, tools and techniques; application of concepts; formulation of innovative and creative solutions to solve problems.	40	
Excellent practical work with results retrieved independently. Your final LR results were a little higher but you are capable equipment-wise. See and please you.		30
5. Skills for Professional Practice Attributes in professional practice: individual and collaborative working; deployment of appropriate media; presentation and organisation.	10	
You can communicate well and work is coherent and fluent		6

Assignment 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 one week late (capped at 40%)

First Attempt?

87 %

FdSc & HN COMMON ASSESSMENT AND MARKING CRITERIA

Assessment Criteria	OUTRIGHT FAIL	UNSATISFACTORY	DISFACTORY	GOOD	VERY GOOD	EXCELLENT	EXCEPTIONAL
	REFER (equivalent to 0-20%)	REFER (equivalent to 30-39%)	PASS (equivalent to 40-49%)	PASS (equivalent to 50-59%)	MERIT (equivalent to 60-69%)	DISTINCTION (equivalent to 70-79%)	DISTINCTION (equivalent to 80-100%)
1. Research-informed Literature Extent of research and/or own reading, selection of credible sources, application of appropriate referencing conventions	Little or no evidence of reading. Views and findings unsupported and non-authoritative. Referencing conventions largely ignored.	Poor evidence of reading and/or of reliance on inappropriate sources, and/or indiscriminate use of sources. Referencing conventions used inconsistently.	References to a limited range of mostly relevant sources. Some omissions and minor errors. Referencing conventions evident though not always applied consistently.	Inclusion of a range of research-informed literature, including sources retrieved independently. Referencing conventions mostly consistently applied.	Inclusion of a wide range of research-informed literature, including sources retrieved independently. Selection of relevant and credible sources. Very good use of referencing conventions, consistently applied.	A comprehensive range of research-informed literature embedded in the work. Excellent selection of relevant and credible sources. High-level referencing skills, consistently applied.	Outstanding knowledge of research-informed literature embedded in the work. Outstanding selection of relevant and credible sources. High-level referencing skills consistently and professionally applied.
2. Knowledge and Understanding of Subject Extent of knowledge and understanding of concepts and underlying principles associated with the discipline.	Major gaps in knowledge and understanding of material at this level. Substantial inaccuracies.	Gaps in knowledge, with only superficial understanding. Some significant inaccuracies.	Evidence of basic knowledge and understanding of the relevant concepts and underlying principles.	Knowledge is accurate with a good understanding of the field of study.	Knowledge is extensive. Exhibits understanding of the breadth and depth of established views.	Excellent knowledge and understanding of the main concepts and key theories. Clear awareness of challenges to established views and the limitations of the knowledge base.	Highly detailed knowledge and understanding of the main theories/concepts, and a critical awareness of the ambiguities and limitations of knowledge.
3. Analysis Analysis, evaluation and synthesis; logic, argument and judgement; analytical reflection; organisation of ideas and evidence	Unsubstantiated generalisations, made without use of any credible evidence. Lack of logic, leading to unsupportable/missing conclusions. Lack of any attempt to analyse, synthesise or evaluate.	Some evidence of analytical intellectual skills, but for the most part descriptive. Ideas/findings sometimes illogical and contradictory. Generalised statements made with scant evidence. Conclusions lack relevance.	Evidence of some logical, analytical thinking and some attempts to synthesise, albeit with some weaknesses. Some evidence to support findings/ views, but evidence not consistently interpreted. Some relevant conclusions and recommendations, where relevant.	Evidence of some logical, analytical thinking and synthesis. Can analyse new and/or abstract data and situations without guidance. An emerging awareness of different stances and ability to use evidence to support the argument. Valid conclusions and recommendations, where relevant.	Sound, logical, analytical thinking; synthesis and evaluation. Ability to devise and sustain persuasive arguments, and to review the reliability, validity & significance of evidence. Ability to communicate ideas and evidence accurately and convincingly. Sound, convincing conclusions / recommendations.	Thoroughly logical work, supported by evaluated evidence. High quality analysis, developed independently or through effective collaboration. Ability to investigate contradictory information and identify reasons for contradictions. Strong, persuasive, conclusions, justifiable recommendations.	Exceptional work; judiciously selected and evaluated evidence. Very high quality analysis, developed independently or through effective collaboration. Ability to investigate contradictory information and identify reasons for contradictions. Highly persuasive conclusions.
4. Practical Application and Deployment Effective deployment of appropriate methods, materials, tools and techniques; extent of skill demonstrated in the application of concepts to a variety of processes and/or contexts; formulation of innovative and creative solutions to solve problems.	Limited or no use of methods, materials, tools and/or techniques. Little or no appreciation of the context of the application.	Rudimentary application of methods, materials, tools and/or techniques but without consideration and competence. Flawed appreciation of the context of the application.	An adequate awareness and mostly appropriate application of well-established methods, materials, tools and/or techniques. Basic appreciation of the context of the application.	A good and appropriate application of standard methods, materials, tools and/or techniques. Good appreciation of the context of the application, with some use of examples, where relevant.	A very good application of a range of methods, materials, tools and/or techniques. Very good consideration of the context of the application, with perceptive use of examples, where relevant. Evidence of some innovation and creativity.	An advanced application of a range of methods, materials, tools and/or techniques. The context of the application is well considered, with extensive use of relevant examples. Application and deployment extend beyond established conventions. Innovation and creativity evident throughout.	Outstanding levels of application and deployment skills. Assimilation and development of cutting edge processes and techniques.
5. Skills for Professional Practice Demonstrates attributes expected in professional practice including: individual initiative and collaborative working; deployment of appropriate media to communicate (including written and oral); clarity and effectiveness in presentation and organisation.	Communication media is inappropriate or misapplied. Little or no evidence of autonomy in the completion of tasks. Work is poorly structured and/or largely incoherent.	Media is poorly designed and/or not suitable for the audience. Poor independent or collaborative initiative. Work lacks structure, organisation, and/or coherence.	Can communicate in a suitable format but with some room for improvement. Can work as part of a team, but with limited involvement in group activities. Work lacks coherence in places and could be better structured.	Can communicate effectively in a suitable format, but may have minor errors. Can work effectively as part of a team, with clear contribution to group activities. Mostly coherent work and is in a suitable structure.	Can communicate well, confidently and consistently in a suitable format. Can work very well as part of a team, with very good contribution to group activities. Work is coherent and fluent and is well structured and organised.	Can communicate professionally and, confidently in a suitable format. Can work professionally within a team, showing leadership skills as appropriate, managing conflict and meeting obligations. Work is coherent, very fluent and is presented professionally.	Can communicate with an exceptionally high level of professionalism. Can work exceptionally well and professionally within a team, showing advanced leadership skills. Work is exceptionally coherent, very fluent and is presented professionally.



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Tom

87

LEVEL/ LEFEL 4

SEMESTER 2

MODULE CODE/ COD Y MODIWL: PSDE4021
ELECTRICAL TECHNOLOGY

ASSESSMENT TYPE/ MATH O ASESU: ASSIGNMENT

ASSESSMENT/COMPONENT/ ASESAD/CYDRAN: 2 OF 2

COMPONENT WEIGHTING/ PWYSAU'R CYDRAN: 25 %

WORD COUNT/ NIFER Y GEIRIAU: 1500 WORDS/O EIRIAU

MODULE TUTOR / TIWTOR Y MODIWL: Steve Roberts

SUBMISSION DETAILS/ MANYLION CYFLWYNO:

- Make sure that Your Name , Your Student P Number, Your Module Title, Assignment Title and Your Module Lecturer's Name are clearly shown on the front page of your assignment
- All assignments must be submitted electronically to Turnitin unless indicated by the module lecturer here:
- If a paper submission is required then it will be indicated here: you will then be required to submit the assignment parts in a suitable report folder— not in poly-pockets - to the library.
- For paper submissions this form (ALL PAGES) MUST be printed out, signed, attached to the front of your assignment and submitted to the library separately from your electronic assignment submission.
- Assignments will not be accepted without this form as it is a requirement that you sign the disclosure regarding the referencing convention.
- DO NOT put this form into Turnitin or it will match many similarities with other students' submissions.



School of Applied Computing ASSIGNMENT SPECIFICATION

Student name:	Tom Waisey	Student P number:	
Programme:	HND/HNC Electrical & Electronic Engineering, Instrumentation Engineering & Power Systems Engineering		
Lecturer:	Steve Roberts	Internal Verifier:	Jason Pointer
Assignment Title:	AC Circuit Lab		
Hand Out Date:	07/03/18	Submission deadline:	09/05/18

Referencing:	In the main body of your submission you must give credit to authors on whose research your work is based. Append to your submission a reference list that indicates the books, articles, etc. that you have read or quoted in order to complete this assignment (e.g. for books: surname of author and initials, year of publication, <u>title of book</u> , edition, publisher: place of publication).		
Disclosure:	I declare that this assignment is all my own work and that I have acknowledged all materials used from the published or unpublished works of other people. All references have been duly cited.		
Student's Signature:	Hardcopy assignments will not be accepted without a signature here 	Date:	

Late submission will result in a late penalty mark, as follows:

Up to one week late, maximum mark of 40% for first attempts and 0% for resubmissions.

(Academic Quality Handbook 2017/18 7.5 (5))

Learning Outcomes tested
(from module syllabus)

1. Produce routine solutions to typical electrical problems.

2. Relate and apply basic electrical theory to collected data.

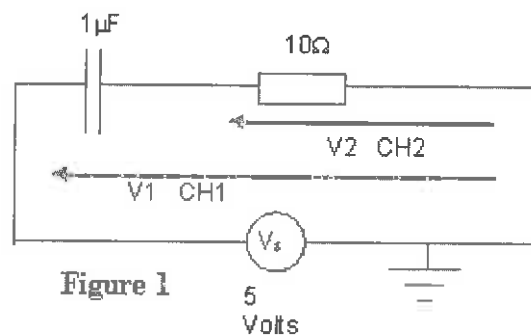
TASK DESCRIPTION

Introduction

An **alternating current (AC)** is an electrical current whose magnitude and direction vary cyclically, as opposed to direct current, whose direction remains constant. Usual the waveform of an AC power circuit is a sine wave, as this results in the most efficient transmission of energy. It is essential to have awareness of ac waveform and the values associated but also the relationship between the current and voltage values.

This assignment will introduce you into some of the different aspects of ac theory and along with practical work.

Task 1 - RC Circuits



- For each of the frequencies in the table below, calculate the value of impedance and hence the magnitude of the current flowing in the circuit of **figure 1**.
- Determine the value of the phase angle between the voltage and the current in the circuit.

Capacitive Circuit Calculations

Frequency (kHz)	$X_C (\Omega)$	Impedance (Ω)	Current (A)	Phase Angle ($^\circ$)
1				
2				
3				
4				
5				
6				
7				
8				
9				

- Build the circuit show in figure 1.
In this circuit the oscilloscope channel 2 is being used to monitor the voltage across the 10Ω resistor. The voltage developed across a known resistor can be used to determine the current flow. As this channel of the oscilloscope is monitoring the current, it can be used to determine the phase angle between the supply current and voltage, that is, the difference in phase between the two waveforms on the oscilloscope.
Use this method to record the supply current and its phase angle with respect the supply voltage.

Capacitive Circuit – Practical Results

Frequency (kHz)	Current (A)	Phase Angle (°)
1		
2		
3		
4		
5		
6		
7		
8		
9		

Task 2 - Equivalent Inductance

- Calculate the equivalent inductance of *figure 2* shown below.
- Simulate the circuit and measure the voltage across each inductor and current drawn by the circuit.
- The circuit in *figure 3* has the following currents through inductors L1, L2 and L3.
 $L1 = 40 \text{ A}$
 $L2 = 8.7 \text{ A}$
 $L3 = 18.26 \text{ A}$
 Calculate the value of each inductive reactance and inductor value.
- Simulate the circuit and compare results with calculated values.

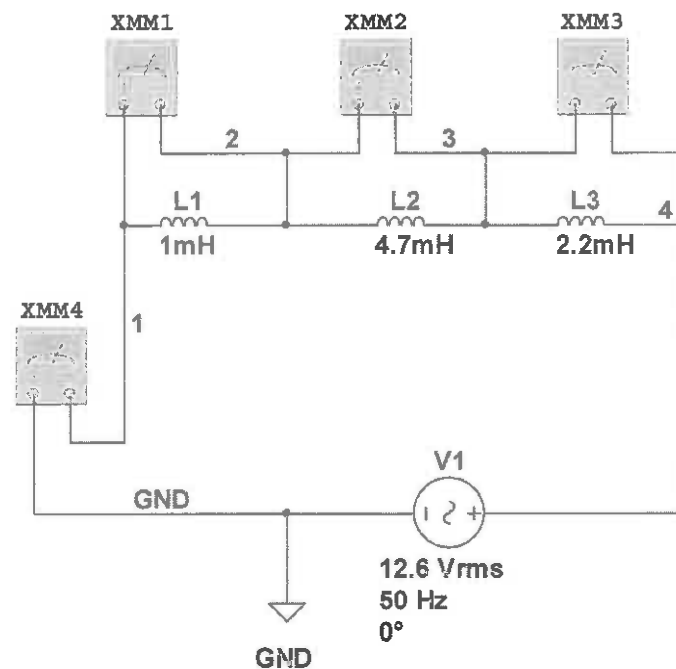


Figure 2

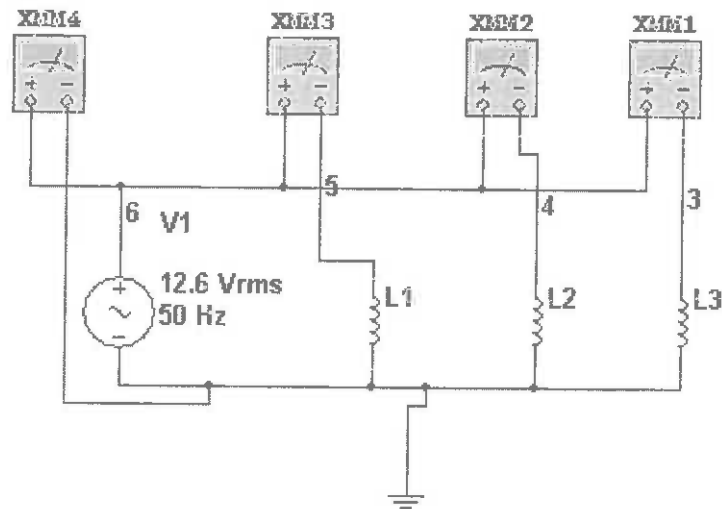
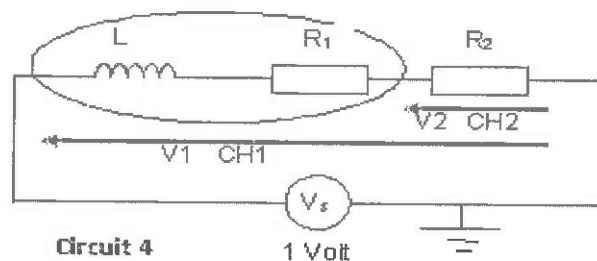


Figure 3

Task 3 - RL Circuits



$L = 1 \text{ mH}$; $R_2 = 10 \Omega$; $R_1 = ? \Omega$ (measure this value)

Figure 4

- For each of the frequencies in the table below, calculate the value of impedance and hence the magnitude of the current flowing in the circuit shown in **figure 4**.
- Determine the value of the phase angle between the voltage and the current in the circuit.

Inductive Circuit Calculations

Frequency (kHz)	$X_L (\Omega)$	Impedance (Ω)	Current (A)	Phase Angle ($^\circ$)
1				
2				
3				
4				
5				
6				
7				
8				
9				

- Build the circuit shown in figure 4.

The oscilloscope channel 2 is being used to monitor the voltage across the 10Ω resistor. The voltage developed across a known resistor can be used to determine the current flow. As this channel of the oscilloscope is monitoring the current, it can be used to determine the phase angle between the supply current and voltage, that is, the difference in phase between the two waveforms on the oscilloscope.

Use this method to record the supply current and its phase angle with respect the supply voltage.

Inductive Circuit – Practical Results

Frequency (kHz)	Current (A)	Phase Angle (°)
1		
2		
3		
4		
5		
6		
7		
8		
9		

Compare the theoretical and practical results. Could a multimeter be used to measure the current flow within the circuit? Why use the oscilloscope? Comment in your conclusions.

Conclusions

Please give conclusions to all your practical activities. In your conclusions you should discuss any discrepancies between calculated and measured values.

GUIDANCE FOR STUDENTS IN THE COMPLETION OF TASKS

- 1. Research-informed Literature:** You must provide evidence of individual research of component and circuit theory, selecting credible sources and application of appropriate referencing conventions.
- 2. Knowledge and Understanding of Subject:** Must show an understanding of concepts and underlying principles associated with ac circuits.
- 3. Analysis:** Provide analysis of the practical activities.
- 4. Practical Application and Deployment:** Show the ability to perform practical work and be able to verify circuit operation against calculated and theoretical results.
- 5. Skills for Professional Practice:** Your work should be well organised and presented in a professional manner.

Tom Wolsey 126039
PSDE4021 ELECTRICAL TECHNOLOGY
Assignment 2- AC Circuit Lab
Steve Roberts

Contents

Introduction.....	3
Task 1 - RC Circuits	3
a).....	3
b).....	3
c).....	4
Task 2 - Equivalent Inductance	6
a).....	6
b).....	7
c).....	7
d).....	8
Task 3 - RL Circuits.....	9
1.....	9
2.....	9
3.....	10
Conclusions.....	11
References.....	12

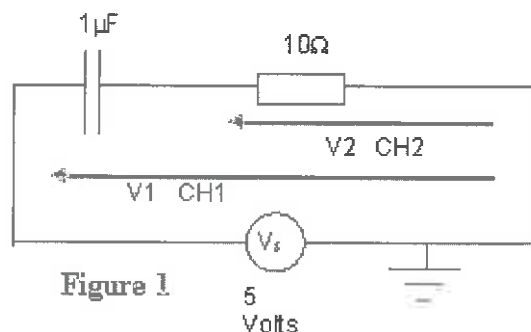
Introduction

In this final assignment for Electronic Technology, there has been given a RC and RL circuit. These circuits require calculation to be carried out on them and practical experiments need to be carried out to check against the calculations.

An alternating current (AC) is an electrical current whose magnitude and direction vary cyclically, as opposed to direct current, whose direction remains constant. Usually the waveform of an AC power circuit is a sine wave, as this results in the most efficient transmission of energy. It is essential to have awareness of ac waveform and the values associated but also the relationship between the current and voltage values.

This assignment will introduce you into some of the different aspects of ac theory and along with practical work.

Task 1 - RC Circuits



a)

For each of the frequencies in the table below, calculate the value of impedance and hence the magnitude of the current flowing in the circuit of *figure 1*.

b)

Determine the value of the phase angle between the voltage and the current in the circuit.

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Capacitive Circuit Calculations

Frequency (kHz)	$X_C (\Omega)$	Impedance (Ω)	Current (A)	Phase Angle ($^\circ$)
1	159	159.5	31.4	86
2	79.5	80.1	62.5	82.7
3	53	53.94	92.7	79.3
4	39.79	41.03	121.9	75.9
5	31.83	33.36	149.88	72.56
6	26.53	28.35	176.37	69.35
7	22.74	24.26	201.29	66.26
8	19.89	22.26	224.62	63.30
9	17.68	20.31	246.18	60.56

Below can be seen an example of the calculations used in the table above, these calculations below where based on a 1KHz frequency.

$$F = \frac{1}{2 * \pi * f * c} = \frac{1}{2 * \pi * 1000 * 1 * 10^{-6}} = 159.1$$

$$Z = \sqrt{R^2 + X_C^2} = \sqrt{10^2 + 159.1^2} = 159.41$$

$$A = \frac{V}{Z} = \frac{5}{159.5}$$

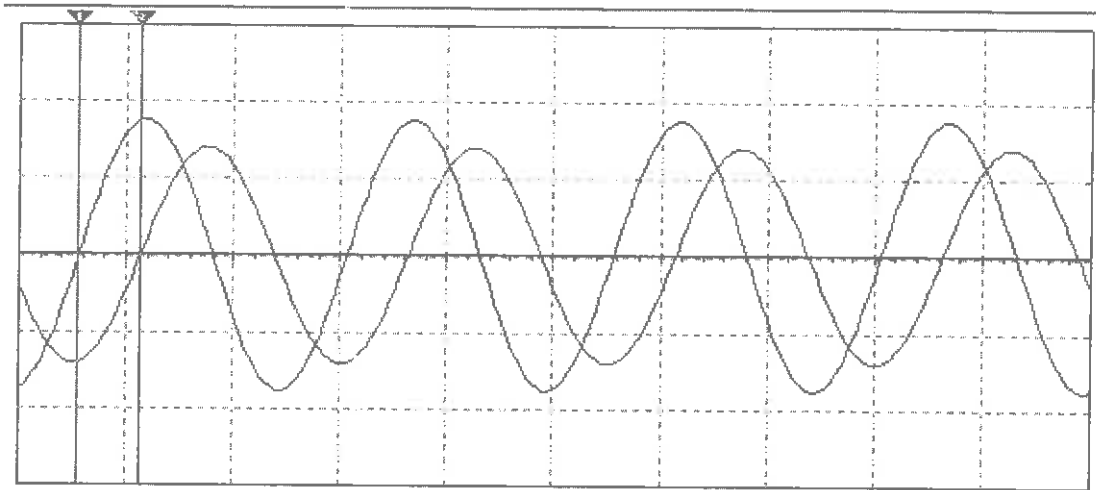
$$\phi = \tan^{-1} \left(\frac{X_C}{R} \right) = \tan^{-1} \left(\frac{159.1}{10} \right) = 86.4^\circ$$

c)

Build the circuit show in figure 1.

In this circuit the oscilloscope channel 2 is being used to monitor the voltage across the 10 Ω resistor. The voltage developed across a known resistor can be used to determine the current flow. As this channel of the oscilloscope is monitoring the current, it can be used to determine the phase angle between the supply current and voltage, that is, the difference in phase between the two waveforms on the oscilloscope.

Use this method to record the supply current and its phase angle with respect the supply voltage.



The setting for the scope where 200 μ s time base with 5V/Div on channel A and 500mV/Div on channel B. The screen capture above has been take from a digital scope connected to the computer for easy reading. Below in the table Capacitive Circuits can be seen the practical measurements that were taken from the circuit. These results are near to the expected calculated and seem to only have a few differences. There are many different reason why these differences could exist. One of these could be the multimeter could have been out of calibration. All the components used all some form of a tolerance. For example, the resistors used have a $\pm 5\%$ tolerance. Then the calculations were carried out they were based on exact values, in a perfect environment.

Capacitive Circuit - Practical Results

Frequency (kHz)	Current (mA)	Phase Angle ($^{\circ}$)
1	31.372	87.84
2	62.479	86.4
3	93.07	81
4	122.91	75.888
5	151.996	72.888
6	179.558	73.514
7	205.482	71.617
8	229.649	63.36
9	252.185	61.076

✓ 50%

Task 2 - Equivalent Inductance

a)

Calculate the equivalent inductance of *figure 2* shown below.

$$L_{\text{Equivalent}} = L1 + L2 + L3$$

$$L_{\text{Equivalent}} = 1 + 4.7 + 2.2 = 7.9\text{mH}$$

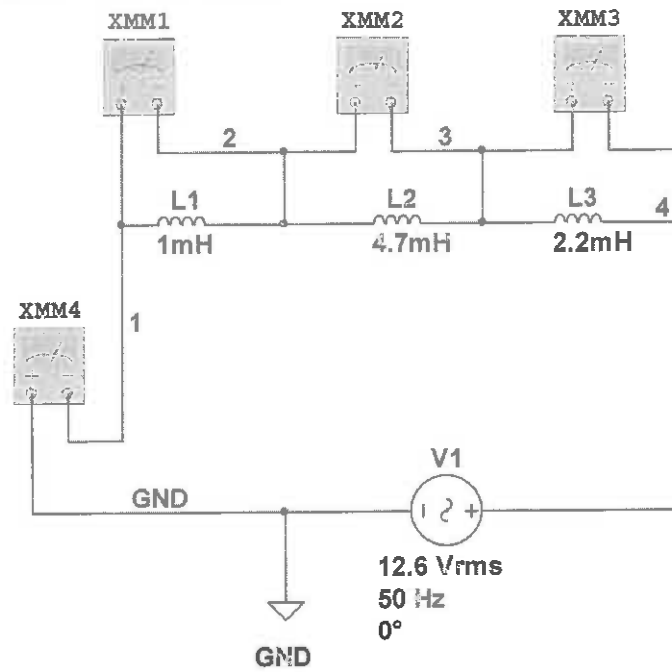
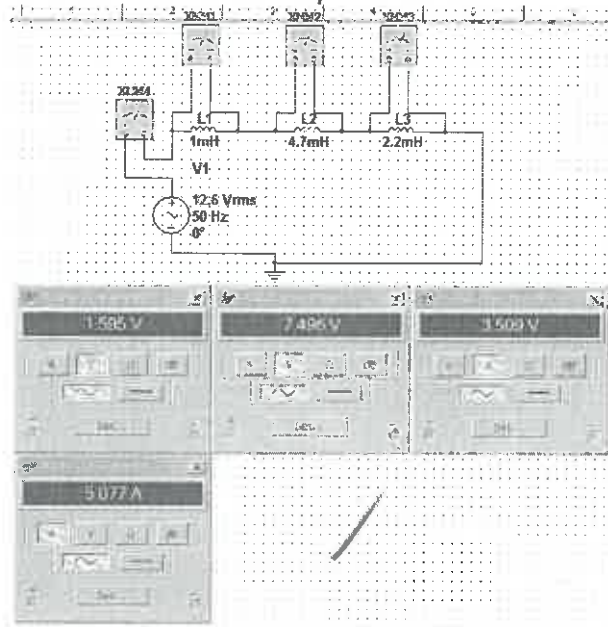


Figure 2

b)

Simulate the circuit and measure the voltage across each inductor and current drawn by the circuit.



c)

The circuit in *figure 3* has the following currents through inductors L1, L2 and L3.

$$L1 = 40 \text{ A}$$

$$L2 = 8.7 \text{ A}$$

$$L3 = 18.26 \text{ A}$$

Below is the value of each inductive reactance and inductor value.

$$I = \frac{V}{XL}$$

$$XL_1 = \frac{V}{I} = \frac{12.6}{40} = 0.315\Omega$$

$$XL_2 = \frac{V}{I} = \frac{12.6}{8.7} = 1.448\Omega$$

$$XL_3 = \frac{V}{I} = \frac{12.6}{18.26} = 0.69\Omega$$

$$XL = 2\pi FL$$

$$\frac{XL}{2\pi F} = L$$

$$L_1 = \frac{0.315}{2\pi \times 50} = 1mH$$

✓ SDP

$$L_2 = \frac{1.448}{2\pi \times 50} = 4.6 \text{ mH}$$

$$L_3 = \frac{0.69}{2\pi \times 50} = 2.2 \text{ mH}$$

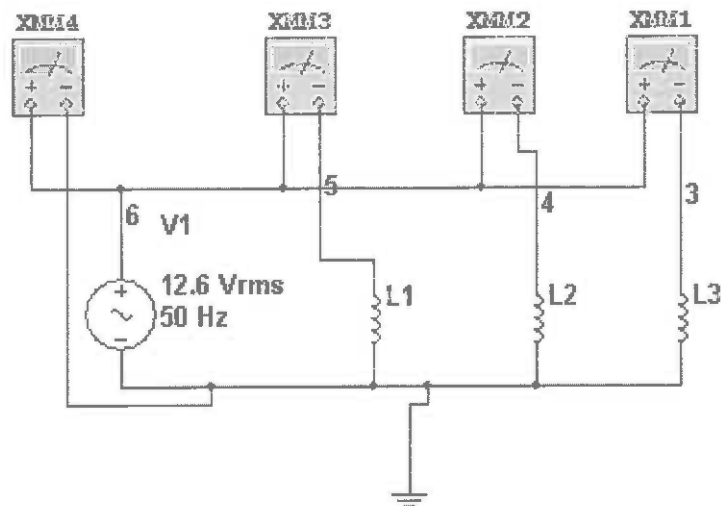


Figure 3

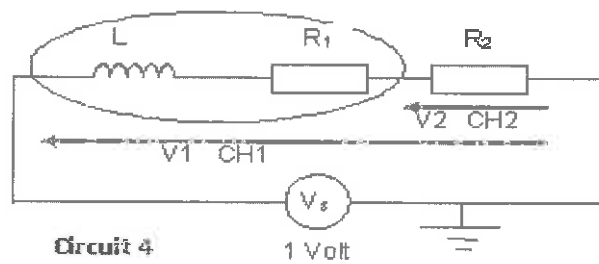
d)

Simulate the circuit and compare results with calculated values.



As can be seen from the screen capture above the it can be seen that the currents measured as near but not exactly the same as the provided values. This could be due to human rounding issues that occurred during the calculation of the new inductor values. These are only very small difference however.

Task 3 - RL Circuits



$L = 1 \text{ mH}$; $R_2 = 10 \Omega$; $R_1 = ? \Omega$ (measure this value)

Figure 4

- For each of the frequencies in the table below, calculate the value of impedance and hence the magnitude of the current flowing in the circuit shown in *figure 4*.
- Determine the value of the phase angle between the voltage and the current in the circuit.
The value that was measured for the resistance value of the inductor was 2.6Ω

Inductive Circuit Calculations

Frequency (f - kHz)	$X_L (\Omega)$ ($2\pi fL$)	R_T ($R + R_L$)	$Z (\Omega)$	Current (A)	Phase Angle ($^\circ$)
1	6.28	12.6	14.08	0.07102	26.50
2	12.57	12.6	17.80	0.05619	44.92
3	18.85	12.6	22.67	0.04411	56.24
4	25.13	12.6	28.11	0.03557	63.37
5	31.42	12.6	33.85	0.02954	68.15
6	37.70	12.6	39.75	0.02516	71.52
7	43.98	12.6	45.75	0.02186	74.01
8	50.27	12.6	51.82	0.01930	75.93
9	56.55	12.6	57.94	0.01726	77.44

Below can be seen an example of the calculation used in the table above, the calculations below are based on a 1kHz frequency.

$$X_L = 2 * \pi * F * L = 2 * \pi * 1000 * 1 * 10^{-3} = 6.28 \Omega$$

$$R_T = R + R_L = 10 + 2.6 = 12.6$$

$$Z = \sqrt{X_L^2 + R_T^2} = \sqrt{6.28^2 + 12.6^2} = 14.08 \Omega$$

1/SDP

$$A = \frac{1}{Z} = \frac{1}{14.08} = 0.07102A$$

$$\phi = \sin^{-1}\left(\frac{O}{H}\right) = \sin^{-1}\left(\frac{6.28}{14.08}\right) = 26.488$$

3.

The circuit shown in figure 4 was build and the required results were obtained.

The oscilloscope channel 2 is being used to monitor the voltage across the $10\ \Omega$ resistor. The voltage developed across a known resistor can be used to determine the current flow. As this channel of the oscilloscope is monitoring the current, it can be used to determine the phase angle between the supply current and voltage, that is, the difference in phase between the two waveforms on the oscilloscope.

Use this method to record the supply current and its phase angle with respect the supply voltage.

In the table below, there can be seen the results for the circuit when it was built and measured.

Inductive Circuit - Practical Results

Frequency (kHz)	Current (A)	Phase Angle (°)
1	0.07	27.12
2	0.056	45.42
3	0.044	55.93
4	0.035	45.76
5	0.0293	69.49
6	0.0248	68.34
7	0.0215	104.4
8	0.019	103.68
9	0.0249	109.82

The formulas that where used to calculate the values in the table above can be seen below.

$$\phi = t * f * 360$$

In the table above Inductive Circuit, the practical results obtained from the circuit have been used to calculate the results. These numbers match the calculated and expected results. There are slight differences these can be caused by many different reasons, for example tolerances in the components as the resistors used had a +-
Yes your results are a little high

5% tolerance. There could also be errors when the rounding of the number took place in both the calculations and in the practical results. The test equipment could also be slightly out of calibration.

Conclusions

Throughout the task an oscilloscope has been used to measure the t as a value. This has been important throughout the tasks, as the value has played a big part in many of the different calculations required to obtain the values required. As with any practical experiment there have been a number of discrepancies, these have been because there are tolerances in the components used. The equipment used can also not be guaranteed to be perfect results. A multimeter can't be used to measure the current in the circuit because the circuit was working over 1KHz frequency. When a multimeter is used to measure current over 1KHz it will start to give false readings. The circuit is a high impedance circuit and the measuring device also needs to be high impedance which is why an oscilloscope was used. Some of the discrepancies in the measurements could have also been when trying to get the cursors on the digital scope.



JDP

References

Series Resistor-Capacitor Circuits | Reactance And Impedance -- Capacitive | Electronics Textbook. 2018. Series Resistor-Capacitor Circuits | Reactance And Impedance -- Capacitive | Electronics Textbook. [ONLINE] Available at: <https://www.allaboutcircuits.com/textbook/alternating-current/chpt-4/series-resistor-capacitor-circuits/>. [Accessed 18 May 2018].

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Alternating Current (AC) vs. Direct Current (DC) - learn.sparkfun.com. 2018. Alternating Current (AC) vs. Direct Current (DC) - learn.sparkfun.com. [ONLINE] Available at: <https://learn.sparkfun.com/tutorials/alternating-current-ac-vs-direct-current-dc>. [Accessed 18 May 2018].