Wakefield College
Castleford Campus
Centre No 38210B **School of Engineering and Motor Vehicle**

Programme Details

Edexcel	Programme No(s)	This student	Programme Titles
	ML 041		HNC Electrical Engineering
	ML 049		HNC Mechanical Engineering

Unit Details

Unit No	Unit Title	Level
2	Engineering Science	QCF 4

Assignment Details

Original Author		Umar F Khan		
Nº	Title	Assessor	Audit Ref	IV Ref
3	DC & AC Theory	Michael Schonborn	HES 106	

Issue Date	Hand in Date	Actual Hand in Date

Time for completion: 4 weeks

Student Details

Name	

Statement	I certify that the work carried out in this assignment is my own
Signature	

Criteria	3.1	3.2	3.3	4.1	4.2	4.3	M1	M2	M3	D1	D2	D3
Achieved												

Assessment Feedback Report

Unit Title: **Engineering Science**

Outcome 3 **Be able to apply DC theory to solve electrical and electronic engineering problems.**
Outcome 4 **Be able to apply single phase AC theory to solve electrical and electronic engineering problems**

Learners Name **……**

Assessment Criteria	Achieved	Comments/feedback
3.1 Solve problems using Kirchhoff's laws to calculate currents and voltages in circuits.		
3.2 Solve problems using circuit theorems to calculate currents and voltages in circuits.		
3.3 Solve problems involving current growth / decay in an L-R circuit and voltage growth / decay in a C-R circuit.		
4.1 Recognise a variety of complex waveforms and explain how they are produced from sinusoidal waveforms.		
4.2 Apply AC theory to solve problems on R, L, C circuits and components.		
4.3 Apply AC theory to the solution of problems on transformers.		
M1 Effective judgements have been made. This can be achieved by solving task2 (3.1) by using superposition theorem and commenting on both methods to which one is better than the other		
M2 A range of methods and techniques have been applied. This can be achieved by solving Task 6 (a) by using Thevenin's theorem		
M3 Present and communicate appropriate findings. *This could be demonstrated by using technology to produce the graph of current vs time in the LR question.*		

D1 The validity of results has been evaluated using defined criteria. This can be achieved by finding resonant frequency of Task1 by using graphical method		
D2 Take responsibility for managing and organizing activities. *This can be demonstrated by producing a variety of complex waveforms, from sinusoidal waves, to support your explanations*		
D3 Demonstrate convergent/lateral/creative thinking. *This can be demonstrated by considering and evaluating concepts about losses in transformers.*		

Scenario
You are working for a company testing telephony system. You are designing a mobile phone charging circuit and filter circuit to interface the GSM phone to a PSTN system.

Tasks

Using RLC circuits

1. To minimise the audio bandwidth for an old PSTN (Public Switched Telephone Network) you are required to limit the audio bandwidth between 300Hz and 3.4kHz. You have to create a range of filter configurations using different components to achieve this.

   - design a High Pass Filter with a cut off frequency of 300Hz using a resistor and an inductor
   - design a Low Pass Filter with a cut off frequency of 3.4kHz using a resistor and a capacitor
   - draw a diagrams for both filter based on your calculation clearly showing the cut of frequency
   - draw the filter circuit clearly indicating: ground, input and output and choose appropriate component values
   - at 1.1kHz control signals are transmitted through the PSTN system you need to design a bandstop or notch filter for this frequency. Design an LC circuit!

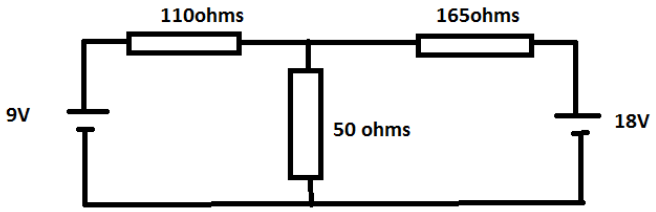
   You have a series circuit consisting of a resistor (10ohms) , a capacitor (4.7uF) and an inductor (2mH) calculate it's impedance at 1.1kHz.

   Criteria 4.2

   Plot the graph of reactance versus frequency and find the value of resonant frequency from the graph. Compare plotted results with calculated in task 1(d) above and comment on the validity.

   Criteria D1

2. You are designing a mobile phone charging circuit. Once the charger is connected there are two independent power sources connected to the mobile phone.
   State Kirchhoff's voltage and current laws. For the circuit shown below, calculate the current in each loop and the potential difference across each resistor.
   Criteria 3.1



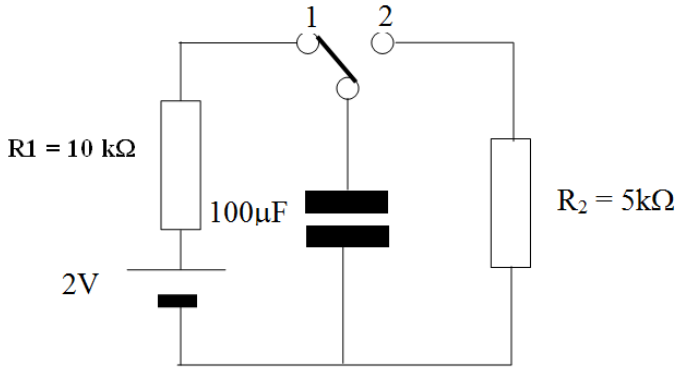
Solve by using superposition method and comment on effectiveness of each method
M1

3 A transformer has a turns ratio of 10:1 and is operated from the mains, it supplies a 20Ω load. Sketch the circuit diagram and determine the primary and secondary voltages and currents.
Criteria 4.3
Explain why the actual results will be different from calculated values.
D3

4. What are complex waves? How can they be produced? Give typical examples of complex waves produced by using sinusoidal signals
Criteria 4.1
Plot two complex waveforms, using any suitable software from sinusoidal waves, to support your explanations.
D2

5. The following circuit is used to retain the memory of a phone when the battery is changed. Position one is the normal charging circle and position two is meant to reset the memory by discharging the capacitor.
The circuit below, the capacitor is initially uncharged. The switch is switched to position 1 for 10 seconds and then switched to position 2 for 5 seconds and then again to position 1 for 5 seconds, calculate

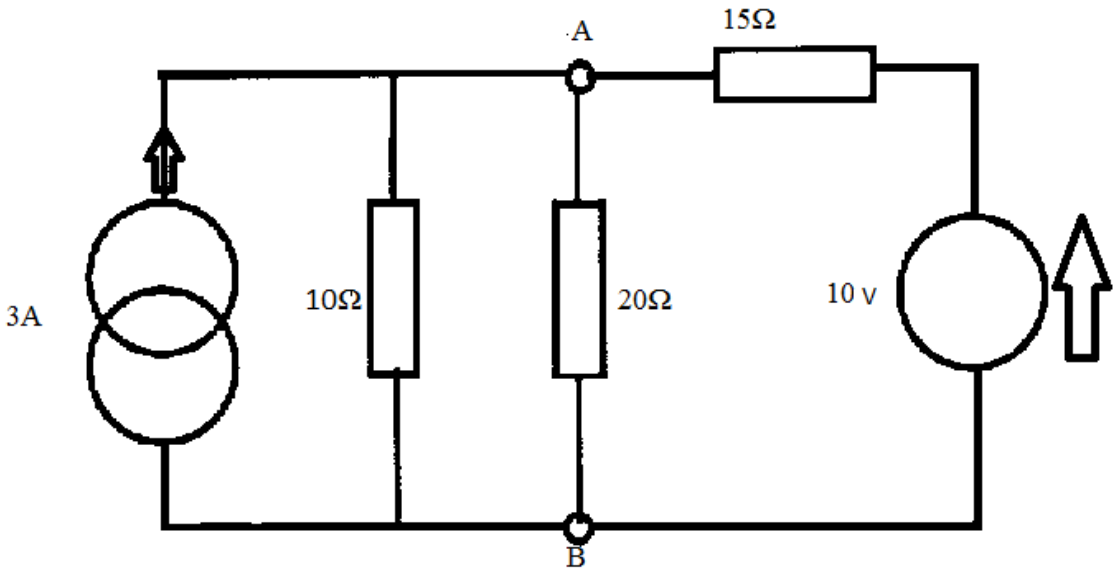
- The time constant for both positions
- Draw rises and decay of the voltage across the capacitor and estimate the time required to charge and discharge the capacitor fully.



b. A series RL circuit has a 12 v dc supply, a 20 Ω resistor, and a 150 mH inductor. Assuming that the supply is connected at t = 0, plot the graph of **current vs time**, in the range 0 to 20 ms.

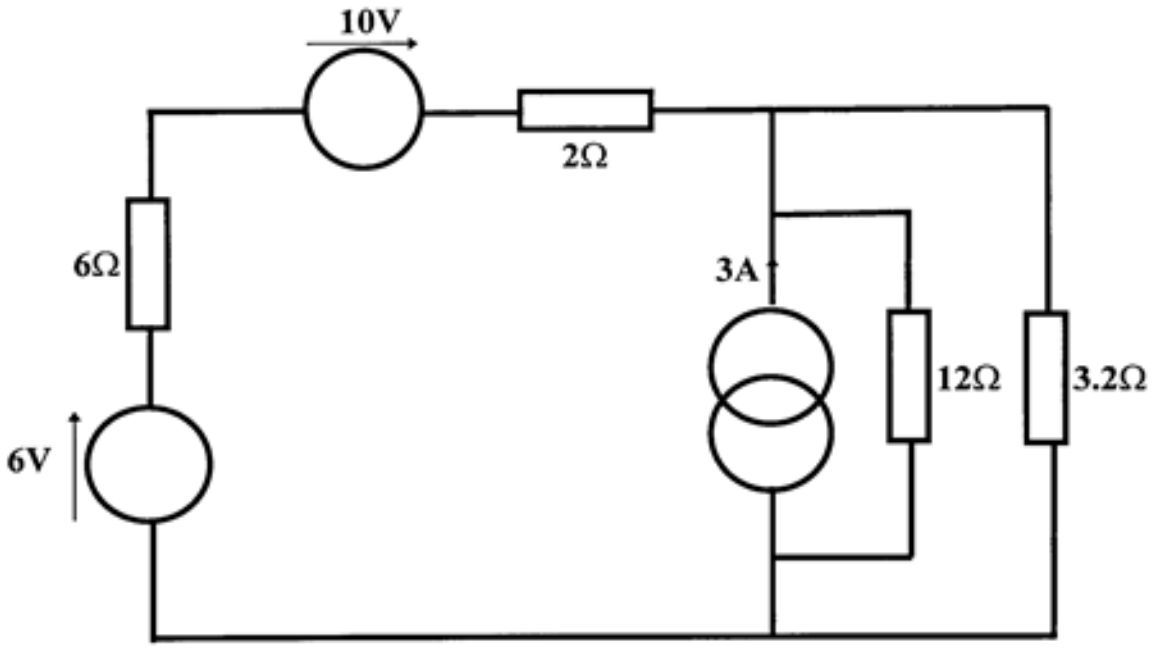
Criteria 3.3 & M3

6. a. Use Norton's theorem to determine the voltage across a 20Ω load resistor placed between terminals A & B in the circuit below



Solve by using Thevenin's theorem
M2

b. Use Thevenin's theorem to calculate the current in the 3.2 Ω resistor in the circuit in the circuit shown below.



Criteria 3.2

Additional Comments

Assessors Signature …… Date ……