EDEXCEL NATIONALS
UNIT 5 - ELECTRICAL AND ELECTRONIC PRINCIPLES

ASSIGNMENT No.2 - CAPACITOR NETWORK

NAME:

I agree to the assessment as contained in this assignment. I confirm that the work submitted is my own work.

Signature Date submitted

Learning outcomes

On completion of this unit a learner should:
1 Be able to use circuit theory to determine voltage, current and resistance in direct current (DC) circuits
2 Understand the concepts of capacitance and determine capacitance values in DC circuits
3 Understand the principles and properties of magnetism
4 Understand single-phase alternating current (AC) theory.

FEEDBACK COMMENTS

This assignment assesses P2, P4, P5, P6 and M2.

Grade Awarded:

Assessor Signature_____ Date:_____

Internal verifier Signature_____ Date:_____

Grading grid

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all of the learning outcomes for the unit. The criteria for a pass grade describe the level of achievement required to pass this unit.

Grading criteria					
To achieve a pass grade the evidence must show that the learner is able to:	**Achieved**	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**Achieved**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**	**Achieved**
P1 use DC circuit theory to calculate current, voltage and resistance in DC networks		**M1** use Kirchhoff's laws to determine the current in all the branches of a network containing two voltage sources, five nodes and power dissipated in a load resistor		**D1** analyse the operation and the effects of varying component parameters of a power supply circuit that includes a transformer, diodes and capacitors	
P2 use a multimeter to carry out circuit measurements in a DC network		**M2** evaluate capacitance, charge, voltage and energy in a network containing a series-parallel combination of three capacitors		**D2** evaluate the performance of a motor and a generator by reference to	
P3 compare the forward and reverse characteristics of two different types of semi-conductor diode		**M3** compare the results of adding and subtracting two sinusoidal AC waveforms graphically and by phasor diagram.			
P4 describe the types and function of capacitors					
P5 carry out an experiment to determine the relationship between the voltage and current for a charging and discharging capacitor					
P6 calculate the charge, voltage and energy values in a DC network that includes a capacitor					
P7 describe the characteristics of a magnetic field and explain the relationship between flux density (B) and field strength (H)					
P8 describe the principles and applications of electromagnetic induction					
P9 use single phase AC circuit theory to explain and determine the characteristics of a sinusoidal AC waveform					
P10 use an oscilloscope to measure and determine the inputs and outputs of a single phase AC circuit.					

PART 1 TYPES AND CONSTRUCTION

Read your notes and watch the video on capacitors and then answer the questions below.

After watching the video on electrical capacitors, answer the following questions.

1. What is a dielectric material used for in capacitors?

_____

_____

2. Describe the construction of a mica capacitor.

_____

_____

3. Describe the construction of an air spaced variable capacitor.

_____

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4. Describe the construction of a tubular plastic capacitor.

_____

_____

5. What special precaution should be taken when connecting an electrolytic capacitor in a circuit?

_____

_____

6. Draw the symbol for an electrolytic capacitor.

7. Draw the symbol for a trimmer.

8. Draw the symbol for a variable capacitor.

9. What is the basic unit of capacitance?

_____

10. What are the sub multiples of capacitance represented by 10^{-3},10^{-6}, 10^{-9} and 10^{-12} ?

_____

_____

11. Name 3 devices that use capacitors.

_____

_____

_____

PART 2 - CALCULATIONS

A capacitor is made from plates with an area of A mm^2 and separated by a dielectric d mm thick. The relative permittivity is ε_r. Calculate the capacitance.
Calculate the energy stored when 150 V d.c. is connected across the capacitor.

STUDENT	A	d	ε_r
1	200	0.2	6
2	400	0.1	4
3	300	0.3	5
4	600	0.1	6
5	500	0.05	4
6	450	0.25	7
7	550	0.4	8
8	800	0.3	5
9	1000	0.2	3
10	1200	o.8	8
11	800	0.05	12

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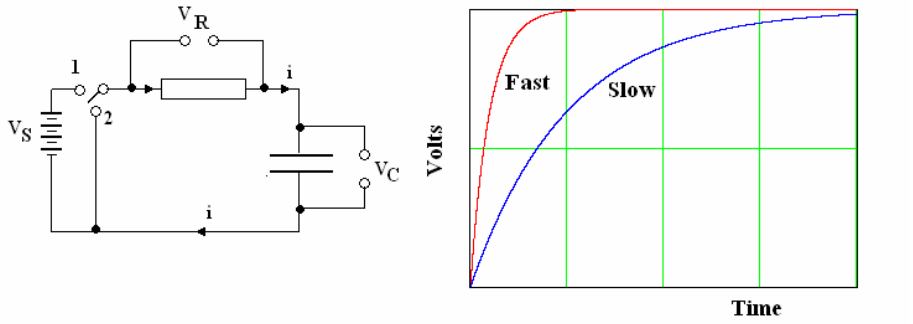
PART 3 **TIME CONSTANT PRACTICAL**

Set up the circuit shown with a suitable capacitor and resistor. When the switch is in position 2 the capacitor discharges and when in position 1 it charges. Connect a suitable recording device to measure V_c and obtain a plot of voltage against time when the capacitor is charged as shown. If a large capacitor and resistor is used you could use a voltmeter and stop clock.



RESULTS

Capacitance = _____ Resistance R = _____

Charging Voltage V_s = _____

Calculate the time constant T = RC = _____

Measure the time constant from the graph by any method you know. Make sure you show how you did this.

_____

_____

Measured time constant = _____

Compare the theoretical and actual time constant.

_____

_____

_____

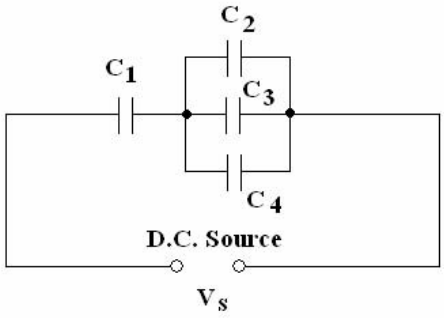
_____

_____

PART 4 - CAPACITOR NETWORK PRACTICAL

It is envisaged that safe apparatus is available in which the individual capacitors can be disconnected and that supervision will ensure that a safe d.c. voltage is used.

Measure the capacitance of each capacitor separately with a multimeter. Look up the nominal value on the side of the capacitor to check that you got it right. Set up the network as shown below and then measure the capacitance at the D.C. Source before you connect it to the source.



Capacitor	Nominal Value	Measured Value
C_1		
C_2		
C_3		
C_4		

Calculate the total capacitance using the measured values.

_____

_____

_____

_____

Calculated value of C_T = _____

Measured value. C_T = _____

Compare the two results and comment on whether the theory predicted the corrected value.

_____

_____

_____

_____

Apply a d.c. voltage of typically 24 V. Measure the voltage across C_1.

Voltage = _____

Calculate the theoretical voltage across C_1.

_____

_____

_____

_____

_____

_____

Comment on whether or not the theory is an accurate way of predicting these values.

_____

_____