BTEC NATIONALS-ELECTRIC AND ELECTRONIC PRINCIPLES
ASSIGNMENT 5
INDUCTION

NAME:	Date Issued
I agree to the assessment as contained in this assignment. I confirm that the work submitted is my own work.	
Signature	Date submitted

	Criteria	Achieved
PASS To achieve a pass grade the evidence must show that the learner is able to:	determine currents, voltages and resistances in dc networks having one voltage source and five components, from practical measurements and calculations	
	describe the relationships between voltage and current for circuits containing series and parallel combinations of components	
	plot graphs showing voltage and current for charging and discharging capacitors from measurements they have obtained from practical experiments	
	plot forward and reverse characteristics of a semiconductor diode from measurements taken using specific components	
	measure and calculate output voltages for transformers in given electrical circuits	
	Describe with the aid of appropriate diagrams, the magnetic fields produced by permanent magnets and electromagnets	
	explain the principle of electromagnetic induction and relate this to typical applications such as motors, generators and transformers	
	determine currents, voltages and impedances in ac circuits containing RL and RC components, from practical measurements and calculations.	
MERIT To achieve a merit grade the evidence must show that the learner is able to:	solve given problems in ac circuits involving RLC networks, and in dc circuits containing multiple voltage sources	
	relate the theory of a range of electrical principles to data obtained experimentally	
	determine from given data the B/H relationship generators by reference to electrical theory. for specific magnetic materials.	
DISTINCTION To achieve a distinction grade the evidence must show that the learner is able to:	analyse the operation of power supply circuits containing transformers, diodes and capacitors, including an appraisal of the effects of varying component parameters	
	predict the performance of given motors and generators by given reference to electrical theory.	

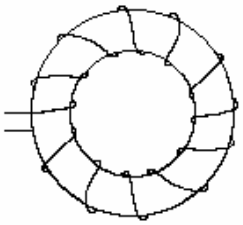
Feedback Comments:

This assignment brief has been internally verified.

Grade Awarded:	Tutor Signature	Date:
Script IV	I.V's Signature	Date:

PART 1 INDUCTANCE

An inductor is made by winding turns of copper wire on a ring as shown.



T is the number of turns.
l is the circumference of the ring in mm.
A is the cross sectional area of the ring in mm^2.
μ_r is the relative permeability

Calculate the inductance.

Student	T	l	A	μ_r
1	100	120	20	12
2	180	150	10	3
3	200	175	40	4
4	300	200	30	3
5	250	220	20	20
6	125	100	15	5
7	80	75	15	30
8	110	80	20	12
9	320	120	18	3
10	220	130	22	18

The inductor is connected in series with a resistor of value 20Ω.

Calculate the direct current when the circuit is connected to a source of 24V d.c.

Calculate the energy stored in the inductor.

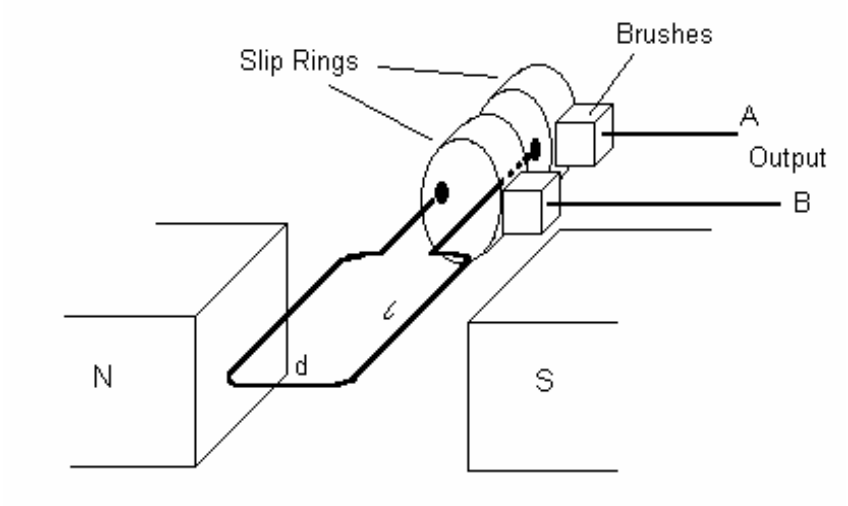
The inductor is now connected across an a.c. source with no resistance.

Calculate the rms current when the source is

a) 24V rms and 50 Hz
b) 24Vrms and 100Hz.

PART 2 GENERATOR PRINCIPLE

The diagram shows a simple single loop generator. The loop has a length l mm and diameter d mm. The flux density is B Tesla and the loop rotates at N rev/s. Calculate the velocity of the conductors and determine the output voltage at the position shown. Determine which terminal is positive and which is negative. The loop rotates clockwise viewed from the front. Explain fully with a suitable diagram how you determined this.



Student	d	l
1	20	40
2	25	30
3	30	30
4	22	50
5	50	75
	6	45
	100	0.7
	7	60
	150	0.5
8	35	75
9	32	64
	10	46
	110	0.5

PART 3 PRACTICAL

In this practical you must verify the theoretical relationship between the turn ratio, voltage ratio and current ratio.

APPARATUS

The apparatus is a separate primary and secondary coil, which fits over an iron core and is clamped together. The rheostat is placed across the secondary coil with maximum resistance and then adjusted to produce a secondary current of about 1 Ampere.

Make a neat diagram showing the apparatus and all the meters used to take measurements.

THEORY

In a perfect transformer when no energy is lost the relationship between the rms voltage, current and the turns in the windings is given by the expression

$$\frac{V_2}{V_1} = \frac{I_1}{I_2} = \frac{T_2}{T_1}$$

where T_2 is the number of turns on the secondary winding.
T_1 is the number of turns on the primary winding.
V_2 is the voltage from the secondary winding.
V_1 is the voltage into the primary winding.
I_1 is the current into the primary winding.
I_2 is the current from the secondary winding.

The primary winding has 2400 turns and 240 V throughout.

The secondary windings has either 43 turns or 130 turns.

A rheostat (variable resistance) is connected across the secondary to draw power that is dissipated as heat. Adjust the rheostat to give a secondary current of about 1 Ampere. Monitor the input and output voltages and currents and record them.

- ***Calculate the theoretical output voltage and input current and compare them to the measured values.***
- ***Find out and explain the meaning and cause of eddy currents in the iron core of inductors and transformers.***
- ***Find out and explain why the power output of a transformer isles than the power input.***
- ***What design features are used in transformers to make them as efficient as possible.***

PART 4 PROBLEM SOLVING

A transformer has T_1 primary turns. The a.c. voltage applied to the primary winding is V_1. The voltage required at the secondary winding is V_2 and the current is I_2 Amperes. Determine the following.

i. The number of turns on the secondary winding.
ii. The current in the primary winding.
iii. The electric power put into the primary winding.

Student	T_1	V_1	V_2	I_2
1	4500	240	24	2
2	2000	110	24	3
3	500	110	5	20
4	1000	415	240	10
5	800	415	110	12
6	3000	240	12	4
7	2500	110	12	8
8	1500	240	5	20
9	750	110	6	17
10	1750	24	5	3