NILE UNIVERSITY OF NIGERIA

HONORIS UNITED UNIVERSITIES

Faculty of Natural and Applied Sciences
Department of Physics

PHY 108
Electricity and Magnetism
EXPERIMENT 4: TRANSFORMER

Student Name:

Student ID:

Department:

Date of Experiment:

Group:

EXPERIMENT ON TRANSFORMER

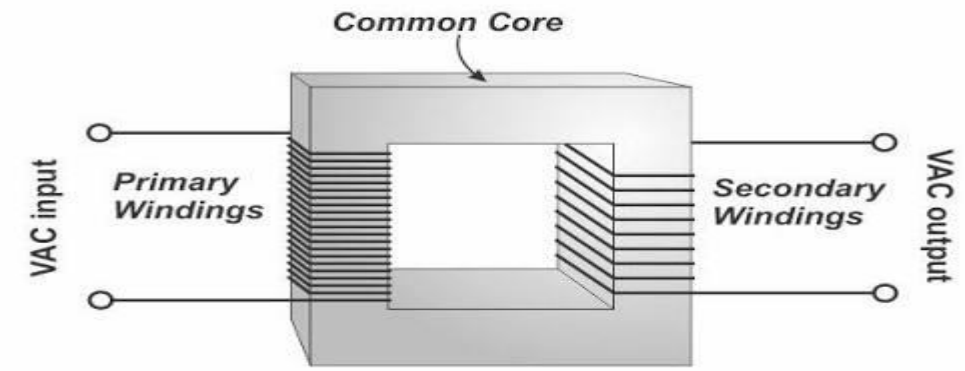
OBJECTIVES:

Determining the secondary voltage of a Transformer as a function of
Number of turns in the primary coil
Number of turns in the secondary coil
Primary voltage

THEORETICAL BACKGROUND

A **Transformer** is a static electrical machine which transfers AC electrical power from one circuit to the other circuit at the constant frequency, but the voltage level can be altered that means voltage can be increased or decreased according to the requirement.

When the output voltage of a transformer is bigger than the input voltage, the transformer is said to be a **STEP UP TRANSFORMER** and the **vice versa** is said to be **STEP DOWN TRANSFORMER**. In a step up transformer there are more coils of wire on the secondary coil than on the primary coil.
Transformers are used in the national grid.



How a transformer works

Alternating current (ac) in the **primary coil** (input coil) produces a changing magnetic field in the **laminated soft iron core**. The changing magnetic field induces a potential difference (voltage) in the **secondary coil** (output coil).

Equations for transformers

We can work out the transformer output voltage if we know the input voltage and the number of turns (coils) on the primary and secondary coils, using the equation below:

$\mathbf{V_p}$ = potential difference (voltage) input on the primary coil
$\mathbf{V_s}$ = potential difference (voltage) output on the secondary coil $\mathbf{N_p}$ = number of turns (coils) of wire on the primary coil
$\mathbf{N_s}$ = number of turns (coils) of wire on the secondary coil

$$\frac{V_p}{V_s} = \frac{n_p}{n_s}$$

Transformers are very efficient devices, if we assume they are 100% efficient (no energy wasted), then the electrical input power will equal the electrical output power and that gives a new equation as;

$$V_p I_p = V_s I_s$$

Where I_p is the current in the primary coil and I_s is the current in the secondary coil.

SETUP AND PROCEDURE

Fig. 1: Experimental set-up for investigating the laws governing the transformer.

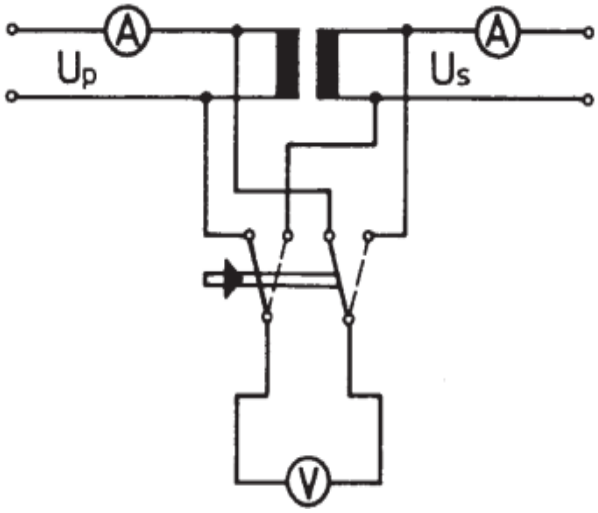


Fig. 2 Transformer connection circuit Diagram

Task 1: Number of turns in the primary coil
Setup the experiment as shown in fig. 1 above
Set the number of turns in the secondary **(N_s)** and the voltage in the primary **(V_p)** windings constant
Read and record the voltage in the secondary as you vary the number of turns in the primary windings **(N_p)**

Task 2: Number of turns in the secondary coil
Now keeping the number of turns primary (N_p) and Primary voltage (V_p) constant
Measure the secondary voltage (V_s) by varying the number of turns in the secondary coil from 14turns, 50turns, 90turns, 120turns, to 140turns respectively.

Task 3: Measuring the Secondary Voltage (V_s) of a Transformer By varying the Primary voltage (V_p)
Setting the number of turns primary (N_p) and the secondary coils (N_s) constant
Measure the corresponding secondary Voltage by varying the primary voltage from 2V, 4V, 6V, 8V, to 10V.

DATA

Task 1: Tabulate your readings in the table below

S/N	N_p	V_s (V)	$1/N_p$
1			
2			
3			
4			
5			

Task 2: Tabulate your readings

S/N	N_s	V_s (V)
1		
2		
3		
4		
5		

Task 3: Measuring Secondary Voltage of a Transformer By varying the Primary voltage

S/N	V_p	V_s (V)
1		
2		
3		
4		
5		

Instructor signature and Date_____

TITLE: **SCALE:**

TITLE: **SCALE:**

ERROR ANALYSIS

Do error analysis of your results and describe the transformer as used in the Experiment.

PRECAUTION : State any precautions taken to ensure accurate result.

CALCULATIONS

1) Evaluate the slope of the two graphs

2) A Step-Up Transformer connected to a 120-V (rms) AC line is to supply 13,000V (rms) for a neon sign. To reduce shock hazard, a fuse is to be inserted in the primary circuit; the fuse is to blow when the rms current in the secondary circuit exceeds 8.50 mA.

(a)What is the ratio of secondary to primary turns of the transformer?

(b) What power must be supplied to the transformer when the rms secondary current is 8.50mA?

(c) What current rating should the fuse in the primary circuit have?

3) In transformer, alternating current is induced in which of the coil