جامعة بيرزيت
BIRZEIT UNIVERSITY

Faculty of Engineering and Technology
Electrical and Computer Engineering Department

ENEE2102
CIRCUITS LAB

Student's name: ***Anas Abdelhalim Tomaizeh***

Student is number: 1152325

Report for Experiment_#5

FLUX PRODUCED BY FIELD COILS

Date:9/11/2017

Eng.Qais samara

DR.Hakam Shehada

Partner's Name: M.Barakat AND IZZ Aldaradee.

Abstract:

- ***The aim of this experiment*** **is to see the effect and to understand some of the information of the flux produced by field coil.**

- ***The methods used:*** **In this experiment, we connected some of different circuits containing transformer using resistors, board, function generator and oscilloscope.**

- ***The main result*****: The results got in laboratory is very logical, when they are compared with theoretical result.**

Theory:

PART A: ELECTRO-MAGNATIC AND FLUX:

when a current flows in a conductor a flux is produced in the direction as given by the right hand grip rule, the thumb represents the direction of the current and the fingers represent the direction of the flux surrounding the conductor, and the magnitude of the flux is given by the formula: B =Ø /A,

Where: Ø is flux in a section of the magnetic circuit, A: is the area.

When the flux in the coil changes, the EMF is induced in the coil, and the magnitude of EMS is given by: $E = N\frac{d\emptyset}{dt}$ "volt", where Ø is the change of flux and it is measured in weber, dt is the change in time and it is measured in seconds, N is the number of turns in the coil.

PART B: TATSNSFORMER:

The transformer consists of two coils *primary* and *secondary*, wounded around a ferromagnetic core. The *primary* coil is connected to the voltage source (AC Source), which produces an alternating magnetic flux, causing an alternating induced current in the *secondary* coil, which is connected to the load. One of the most important equations of the transformer is the 'Impedance Reflection',

which calculates the reflected impedance of the secondary winding on the primary winding, which is defined as:

$$Z_R = r^2 * Z_s$$

Where Z_R is the reflected impedance, Z_S is the secondary impedance and *r* is the ratio of the primary winding turns to the secondary winding turns, or $r = {n_p}/{n_s}$

When *r* is larger than 1, the transformer is called a *Step-down* transformer (the secondary voltage is smaller than the primary voltage), if it's less than 1, the transformer is called a *Step-Up* transformer.

Another relationship describes the transformer: the voltage induced by the alternating flux in any winding coil around the core can be expressed by:

V1/V2 = K1N1 /K2 N2 =N1/N2, where N1 is the number of turns in primary, and N2 is the number of turns in secondary, and K is constant.

There is another relationship describes the transformer: Load current in the secondary will produce a flux, which tends to reduce the main flux I1/I2 =N2/N1.

Procedure:

□ Part A: ELECTRO-MAGNATIC CIRCUITS

1) The connection shown in the figure 1.1 below was connected and V_{in} was set at 6v, after that we noted the pole of the compass needle is deflected towards the centre of the coil.

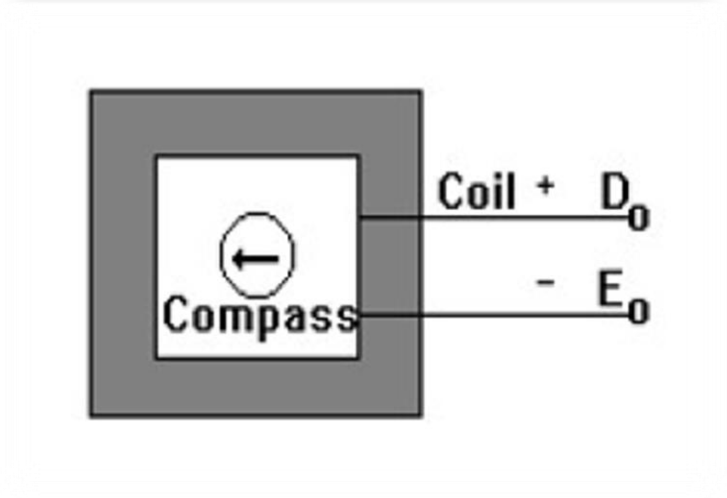

Figure 1.1

2) The connection shown in the figure 1.2 below was connected, after that the terminal F and E connected together and D and G connected to the power supply, after that the power supply was set at 10 Volts and the direction of the flux was seen.

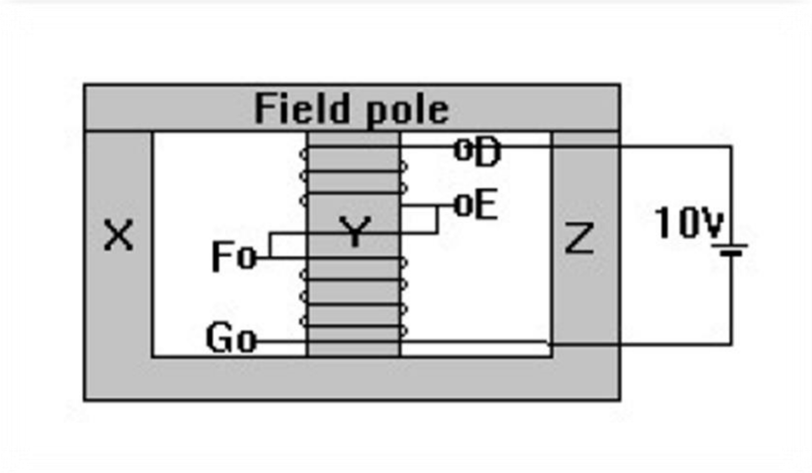

Figure 1.2

3) The connection shown in the figure 1.3 below was connected, and the power supply was set at 10 Volts, after that the DMM was used to close the filed pole to attach the ends X, Y and Z.

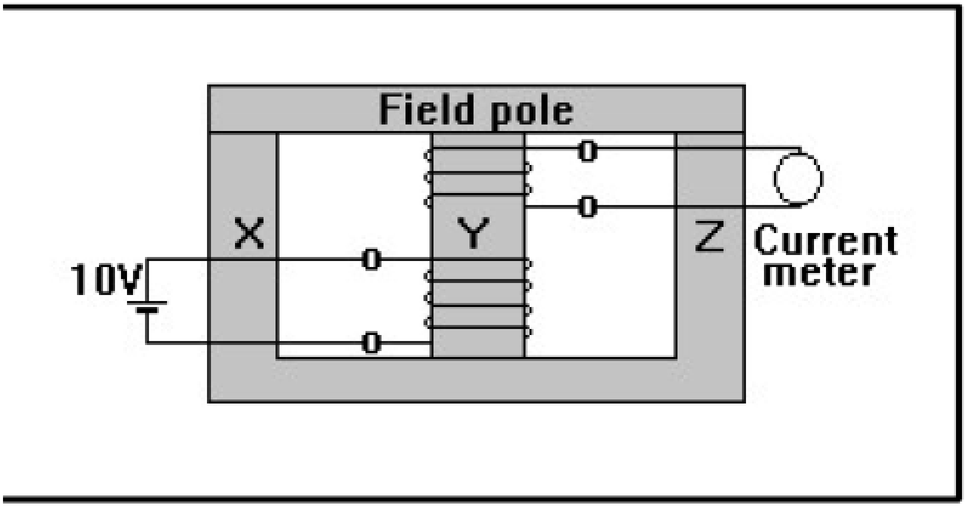

Figure 1.3

Part B: Transformer:

1) The circuit shown in the figure 2.1 was connected and $V_{in}(t)$ is sinusoidal with $f = 5KHZ$, after that the primary and secondary voltages were measured used oscilloscope. The results were recorded in table 1.

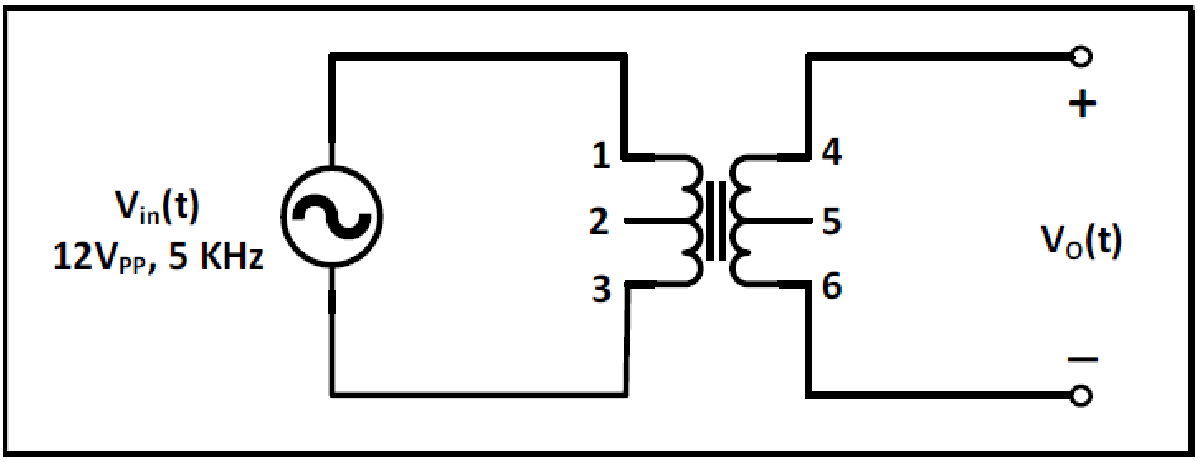

Figure 2.1

2) The circuit shown in the figure 2.2 was connected, and V_{in} was set at 3 $V_{p\text{-}p}$ and f = 5KHZ, after that the primary and secondary voltages and currents were measured. The results were recorded in table 2.

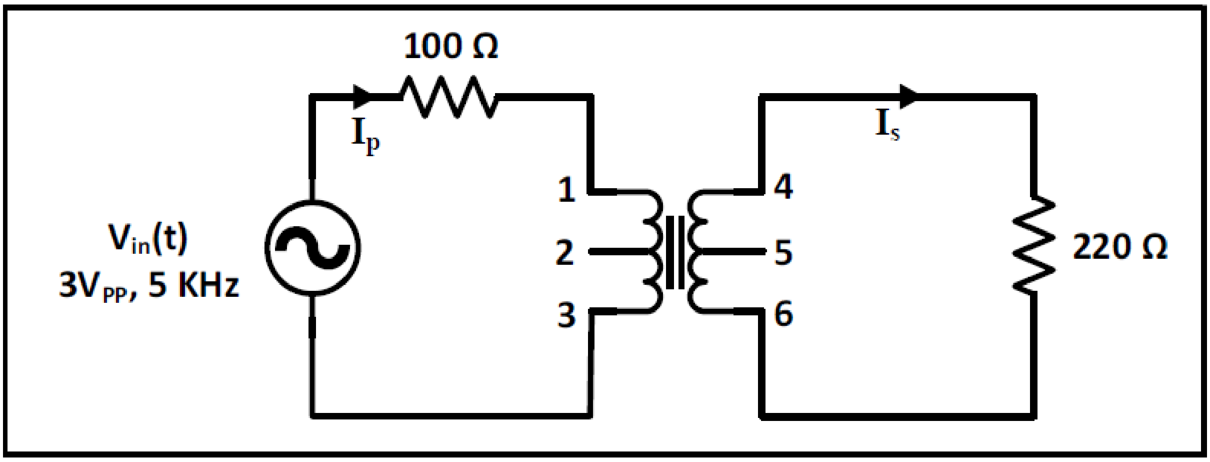

Figure 2.2

3) The circuit shown in the figure 2.3 was connected, and V_{in} was set at 4 $V_{p\text{-}p}$ and f = 5KHZ, after that the V_p, V_s, I_p and I_s were measured using DMM. The results were recorded in table 4.

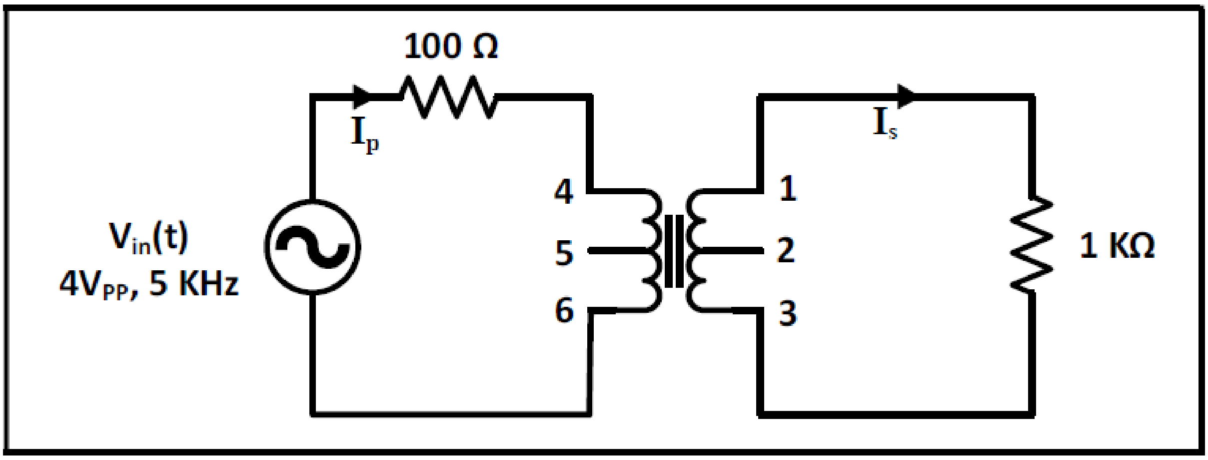

Figure 2.3

Data and calculation and discussion of the question:

Data Tables:

Table.1

Measure		Calculate	
V_P	V_S	□	a (turns ratio)
12V	6.4V	zero	12/6.4= 2:1

Table.2

Measure				
V_P	V_S	V_{RP}(100 Ω)	I_P	I_S
0.97V	0.46V	0.02V	0.24mA	0.44mA

Table.3

Calculate					
A	a	I_P	I_S	$Z_{P,\ Theo}$	$Z_{P,\ expe}$
2.10	2.3	0.20mA	0.46mA	4.04K	4.375K

Table.4

Measure				Calculate		
V_P	V_S	I_P	I_S	S_P	S_S	a
0.96V	1.6V	3.26mA	1.58mA	3.1mW	2.5mW	0.6mW

Here is the answer of the questions:

Q1) the turn's ratio is a = N_p / N_s = V_p / V_s = 12/6.4 = 2:1

(The result was recorded in table 1).

Q2) The turn's ratio is a = V_p / V_s = 0.97/0.46 = 2.1

Or the turn's ratio is a = I_s / I_p = 0.46/0.20 = 2.3

(The result was recorded at table 3).

Q3) The secondary current $I_s = V_s/R_l$ = 0.46/1K = 0.46mA

The primary current $I_p = V_{rp}/R_p$ = 0.02/100 = 0.2mA

(The result was recorded at table 3).

Note that: the calculated values are approximately as experimental values.

Q4) The magnitude of the reflected impedance theoretical Z_p is : $Z_p = a^2 * Z_s$

= $(2.1)^2$ * (1K) = 4.4K

Q5) The magnitude of the reflected impedance $Z_p = \frac{Vin}{Ip}$

= 0.97/0.24m = 4.04K

Q9) The turn's ratio is $a = V_p/V_s$ = 0.96/1.6 = 0.6

**** The transformer is step-Up transformer.**

Q10) The apparent power is:

$S_s = V_s * I_s$ = 1.6 *1.58m = 2.528mW.

$S_p = V_p * I_p$ = 0.96*3.26 = 3.1296mW.

**** There are not equals.**

Conclusion:

□ Part A: ELECTRO-MAGNATIC CIRCUITS

When the current passes through the coil, it generates a magnetic field, and the direction of the magnetic field is given by right hand rule. In LAB we proofed this theorem and we checked the direction of the magnetic field used compass. The result of this part is acceptable but with a small error. For example, in the setting of the power supply we didn't put it at the same voltage that is needed for calculation (about 0.1 volt difference), if we need to improve this ,we need to use the electronics power supplies.

□ Part B: Transformer:

In this part, we verified the relationships between the voltages and currents in the primary and secondary of the transformer, and they were compared to the theoretical results, they were approximately the same. We noted some errors

in this part.For example, we used the oscilloscope to measure the V_{p-p} and convert it in the RMS value so the result was rounded and we lost some of significant.