INVESTIGATORY PROJECT ON TRANSFORMER XII

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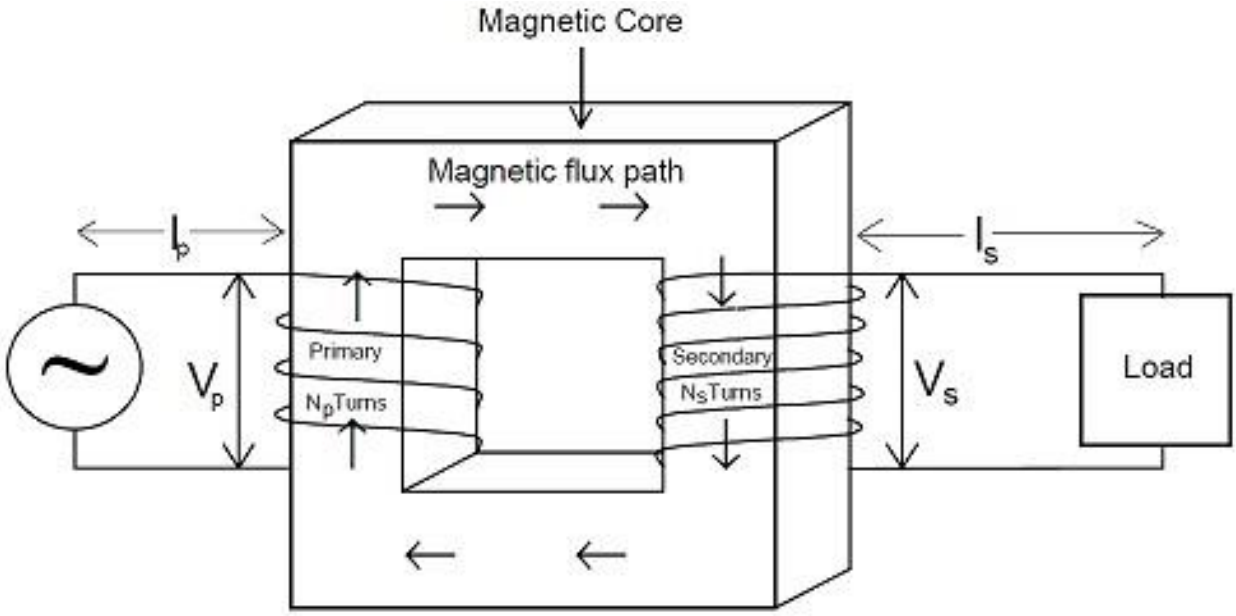
AIM:-

<u>To investigate the relation between the ratio of :</u>

<u>1.</u>Output and Input Voltage

2.Number of turns in the secondary coil and the primary coil of a self designed transformer.



INTRODUCTION :

The transformer is a device used for converting a low alternating voltage to a high alternating voltage or vice-versa. A Transformer based on the Principle of mutual induction according to this principle, the amount of magnetic flux linked with a coil changing, an e.m.f is induced in the neighboring coil.

A transformer is an electrical device which is used for changing the A.C. voltages. A transformer is most widely used device in both low and high current circuit. As such transformers are built in an amazing strength of sizes.

In electronic, measurement and control circuits, transformer size may be so small that it weight only a few tens of grams where as in high voltage power circuits, it may weight hundred of tones. In a transformer, the electrical energy transfer from one circuit to another circuit takes place without the use of moving parts. A transformer which increases the voltages is called a step up transformer. A transformer which decreases the A.C. voltages is called a step-down transformer. Transformer is, therefore, an essential piece of apparatus both for high and low current circuits.

THEORY :

When an altering e.m.f. is supplied to the primary coil p1p2, an alternating current starts falling in it. The altering current in the primary produces a changing magnetic flux, which induces altering voltage in the primary as well as in the secondary.

In a good transformer, whole of the magnetic flux linked with primary is also linked with the secondary, and then the induced e.m.f. induced in each turn of the secondary is equal to that induced in each turn of the primary. Thus if Ep and Es be the instantaneous values of the e.m.f.'s induced in the primary and the secondary and Np and Ns are the no. of turns of the primary secondary coils of the transformer and

dϕ / dt = rate of change of flux in each turn off the coil at this instant,

we have,

$$Ep = -Np \, d\phi/dt \text{ ------- (1)}$$

and

$$Es = -Ns \, d\phi/dt \text{ ------- (2)}$$

Since the above relations are true at every instant, so by dividing 2 by 1, we get

$$Es / Ep = - Ns / Np \text{ ------- (3)}$$

As Ep is the instantaneous value of back e.m.f induced in the primary coil p1, so the instantaneous current in primary coil is due to the difference (E – Ep) in the instantaneous values of the applied and back

e.m.f. further if Rp is the resistance o, p1p2 coil, then the instantaneous current Ip in the primary coil is given by

$$Ip = E – Ep / Rp$$

$$E – Ep = Ip \, Rp$$

When the resistance of the primary is small, Rp Ip can be neglected so therefore

$$E – Ep = 0 \text{ or } Ep = E$$

Thus back e.m.f = input e.m.f

Hence equation 3 can be written as

$$Es / Ep = Es / E$$

$$= \text{output e.m.f / input e.m.f}$$

$$= Ns / Np = K$$

Where K is constant, called turn or transformation ratio.

PROCEDURE :

- ***Take a laminated iron core and wind a small number [say about 2000] of turns of thick insulated copper wire uniformly on it leaving two free ends P_1 P_2 .***
- ***Wind a large numbers of turns [say 100] of thin insulated copper wire on the opposite arm of the core leaving two free end S_1 & S_2.***
- ***Connect the primary coil to a variable a.c. supply source and secondary to a.c. volt meter of suitable range.***
- ***Connect an a.c. voltmeter across the primary to measure the input voltage.***

OBSERVATIONS :

- ***No. of turns in primary , NP = 2000***
- ***No. of turns in secondary , NS = 100***

S. No.	Input Voltage E_P [volt]	Output Voltage E_S [volt]	E_S/E_P
1.	12 V	240 V	1/20
2.	240 V	12 V	20

RESULT:

Clearly ES/EP = NS/NP within experimental error.

PRECAUTIONS :

- ***Keep yourself safe from voltage.***
- ***While taking the readings of the current and voltage of the a.c. should remain constant.***

SOURCES OF ERROR :

- ***Values of current can be changed due to heating effect.***
- ***Eddy current can changed the readings.***