SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

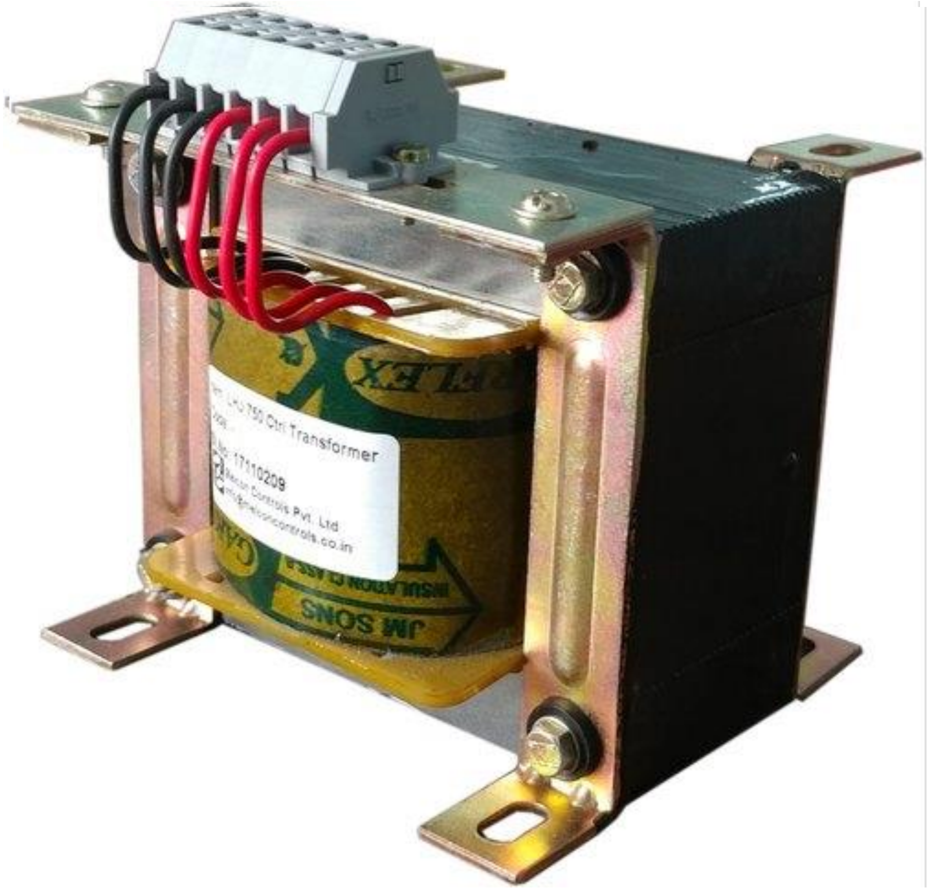
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 23EEB201-THEORY OF DC MACHINES AND TRANSFORMER

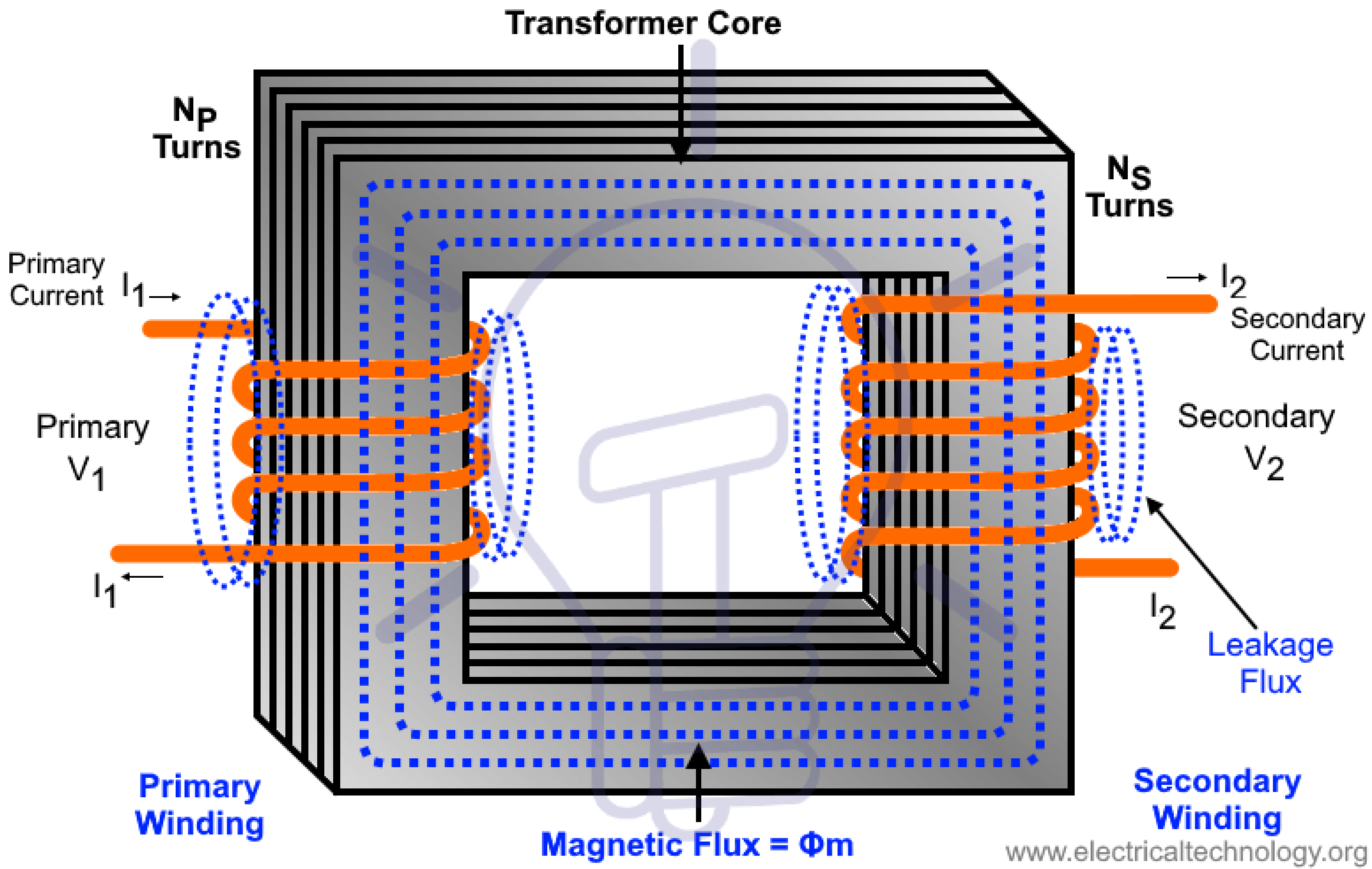
II YEAR /II SEMESTER

Unit 4:
Topic : Transformer

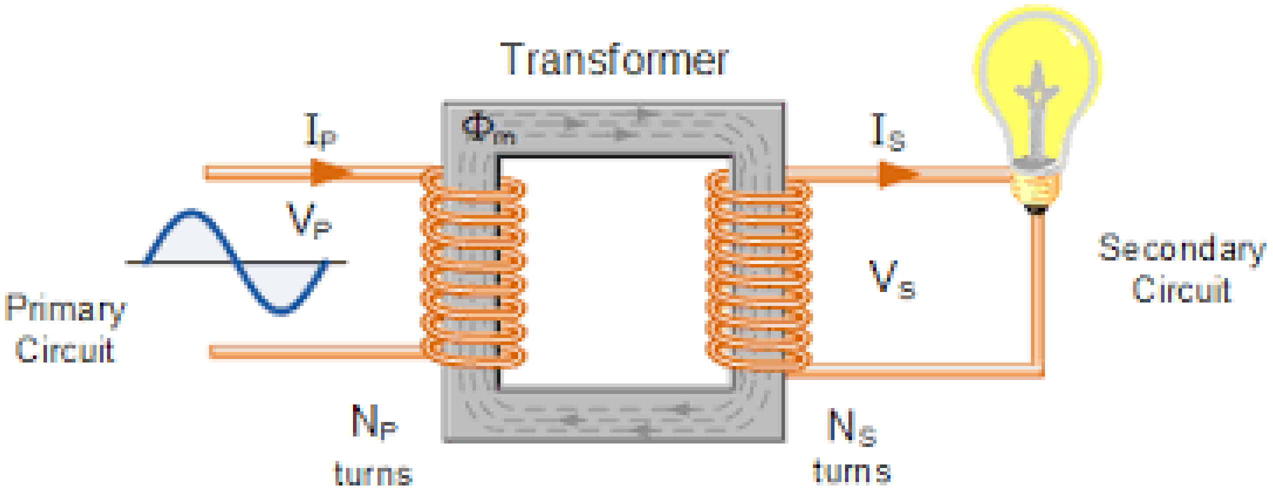
TRANSFORMER



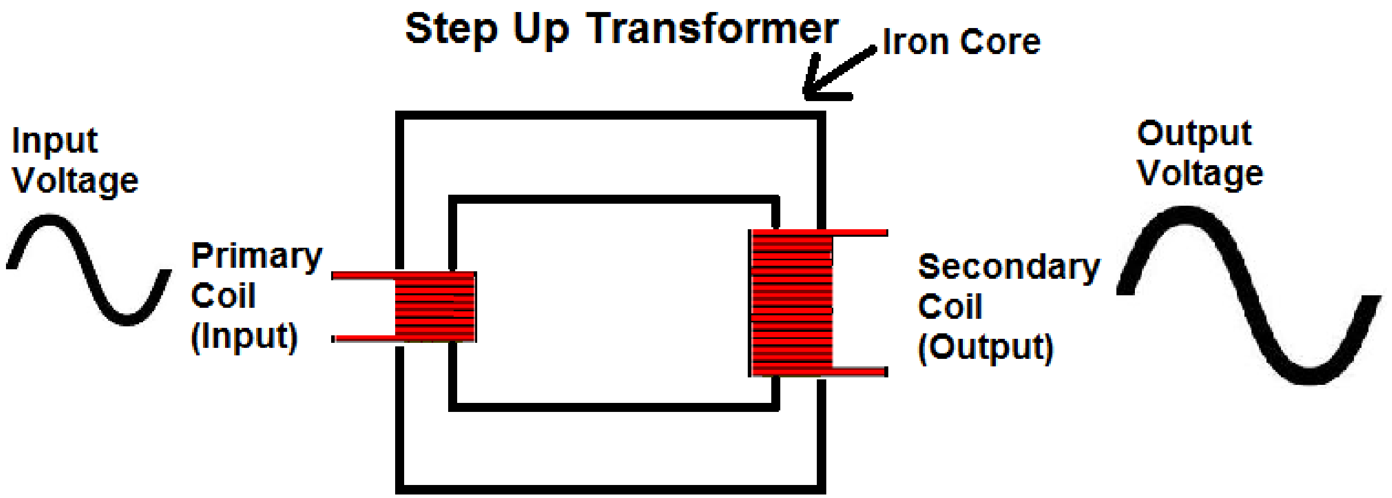
CONSTRUCTION OF TRANSFORMER

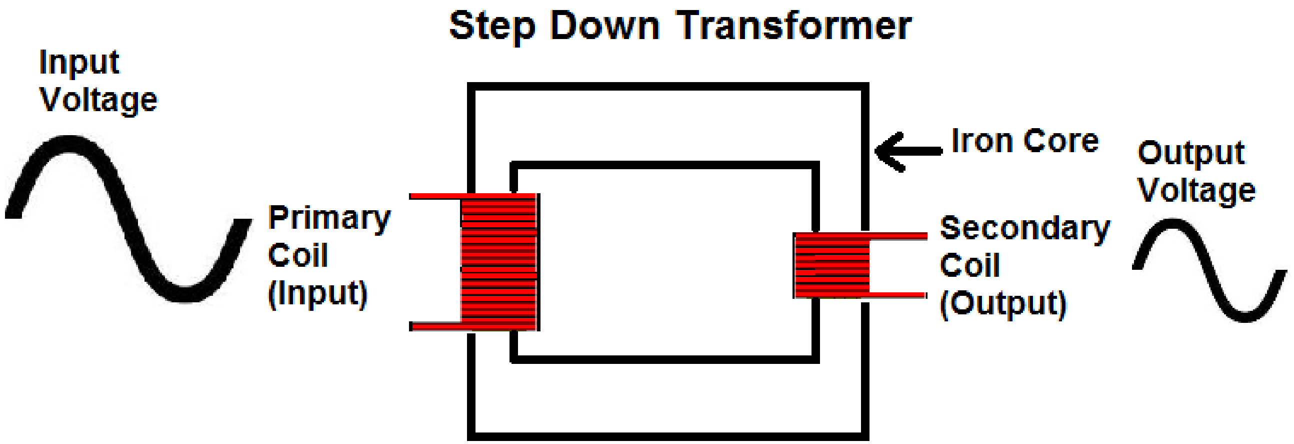


CONSTRUCTION OF TRANSFORMER



CONSTRUCTION OF STEP UP & STEP DOWN TRANSFORMER





EMF EQUATION OF A TRANSFORMER

If we assume sinusoidal AC voltage, then the magnetic flux can be given by,

$$\phi = \phi_{\mathrm{m}} \sin \omega t \cdots (1)$$

Now, according to principle of electromagnetic induction, the instantaneous value of EMF e_1 induced in the primary winding is given by,

$$e_1 = -N_1 \frac{d\phi}{dt}$$

$$\Rightarrow e_1 = -N_1 \frac{d}{dt}(\phi_{\mathrm{m}} \sin \omega t)$$

$$\Rightarrow e_1 = -N_1\, \omega\phi\, cos\, \omega t$$

$$\Rightarrow e_1 = -2\pi f N_1\, \phi_m\, cos\, \omega t$$

Where,

$$\omega = 2\pi f$$

$$\because -cos\, \omega t = \sin(\omega t - 90^\circ)$$

Therefore,

$$e_1 = 2\phi f N_1\, \phi_m \sin(\omega t - 90^\circ) \cdots (2)$$

Equation (2) may be written as,

$$e_1 = E_{m_1} \sin(\omega t - 90^\circ) \cdots (3)$$

Where, E_{m_1} is the maximum value of induced EMF e_1.

$$E_{m1} = 2\pi f N_1 \phi_m$$

Now, for sinusoidal supply, the RMS value E_1 of the primary winding EMF is given by,

$$E_1 = \frac{E_{m1}}{\sqrt{2}} = \frac{2\pi f N_1 \phi_m}{\sqrt{2}}$$

$$\therefore E_1 = 4.44 f\phi_m N_1 \cdots (4)$$

Similarly, the RMS value E_2 of the secondary winding EMF is,

$$E_2 = 4.44 f\phi_m N_2 \cdots (5)$$

In general,

$$E = 4.44 f\phi_m N \cdots (6)$$

Equation (6) is known as EMF **equation of a transformer**.

For a given transformer, if we divide the EMF equation by the supply frequency, we get,

$$\frac{E}{f} = 4.44\,\phi_m N = \text{Constant}$$

Which means the induced EMF per unit frequency is constant but it is not same on both primary and secondary side of the given transformer.

Also, from equations (4) and (5), we have,

$$\frac{E_1}{E_2} = \frac{N_1}{N_2} \text{ or } \frac{E_1}{N_1} = \frac{E_2}{N_2}$$

Hence, in a transformer, the induced EMF per turn in the primary winding is equal to the induced EMF per turn in the secondary winding.

EFFECT OF RESISTANCE AND LEAKAGE REACTANCE

REFERENCES

1. Muthusubramanian R, Salivahanan S, “Basic Electrical and Electronics Engineering”, Tata McGraw Hill Publishers, (2009) - UNIT I – V
2. Bhattacharya. S.K, “Basic Electrical and Electronics Engineering”, Pearson Education , (2017) – UNIT I – IV
3. Mehta V K, Mehta Rohit, “Principles of Electrical Engineering and Electronics”, S.Chand & Company Ltd, (2010)- UNIT I and II
4. Mehta V K, Mehta Rohit, “Principles of Electronics”, S.Chand & Company Ltd, (2005)- UNIT IV and V

THANK YOU