TOPIK 10
TRAFO

TRANSFORMATOR

Sebuah **transformator** (atau yang lebih dikenal dengan nama **trafo**) adalah suatu alat elektronik yang memindahkan energi dari satu sirkuit elektronik ke sirkuit lainnya melalui pasangan magnet. Biasanya dipakai untuk mengubah tegangan listrik dari tinggi ke

rendah dan berarti juga mengubah arus listrik dari rendah ke tinggi selain itu juga dapat mengubah tegangan AC menjadi DC atau sebaliknya.

Transformator umumnya terdiri dari inti (besi) dan dua bagian yaitu bagian primer dan bagian sekunder yang masing-masing mempunyai lilitan dengan jumlah tertentu. Prinsip kerjanya berdasarkan pemindahan daya/energi listrik dari kumparan primer ke kumparan sekunder dengan cara induksi.

Trafo ideal :

$$\frac{Vs}{Ns} = \frac{Vp}{Np}$$

Trafo:

• Step up : Vs > Vp

• Step down : Vp > Vs

Transformator ideal:

Pin = Pout atau Vp Ip = Vs Is

$$\frac{Vp}{Vs} = \frac{Is}{Ip}$$

Transformator tak ideal **:**

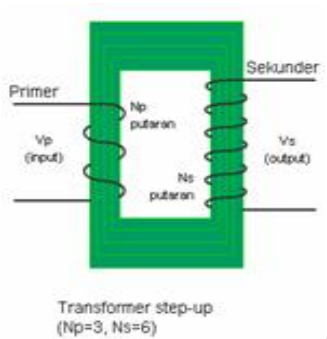
Pin $\neq$ Pout

Pout = η Pin

$\eta = \frac{P_{IN}}{P_{out}}$ x 100%

dimana: η = efisiensi transformator

Gambar Transformator ditunjukkan di bawah ini.



Gambar Transformator

Prinsip Kerja

Coupling by mutual induction

A simple transformer consists of two electrical conductors called the **primary winding** and the **secondary winding**. These two windings can be considered as a pair of mutually coupled coils. Energy is coupled between the windings by the time-varying magnetic field that passes through (links) both primary and secondary windings.

Elementary analysis

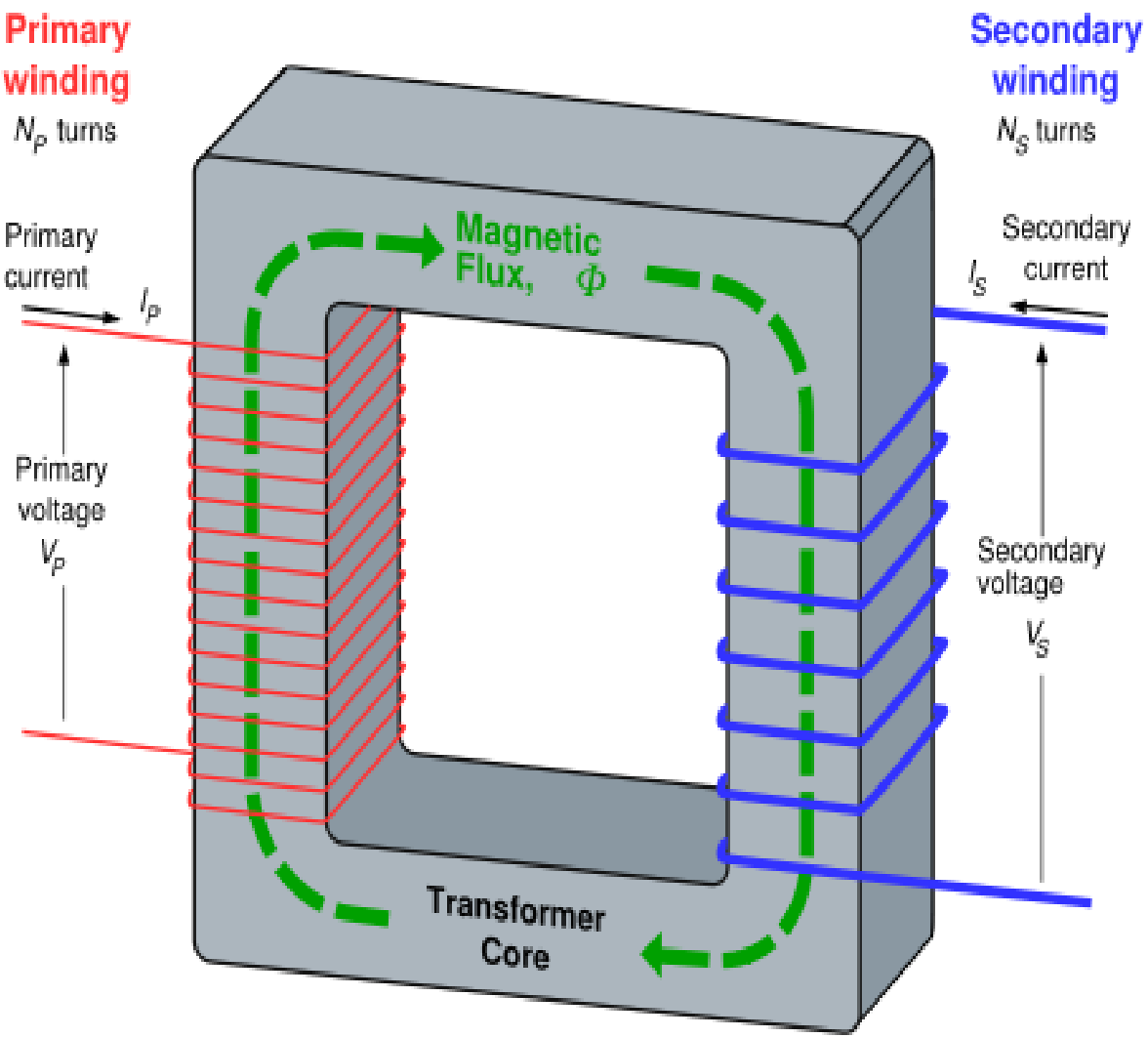
If a time-varying voltage v_P is applied to the primary winding of N_P turns, a current will flow in it producing a magnetomotive force (MMF). Just as an electromotive force (EMF) drives current around an electric circuit, so MMF tries to drive magnetic flux through a magnetic circuit. The primary MMF produces a varying magnetic flux Φ_P in the core, and, with an open circuit secondary winding, induces a back electromotive force (EMF) in opposition to v_P. In accordance with Faraday's law of induction, the voltage induced

across the primary winding is proportional to the rate of change of flux:

$$v_P = N_P \frac{d\Phi_P}{dt} \quad \text{and} \quad v_S = N_S \frac{d\Phi_S}{dt}$$

where

- v_P and v_S are the voltages across the primary winding and secondary winding, respectively,
- N_P and N_S are the numbers of turns in the primary winding and secondary winding, respectively,
- $d\Phi_P / dt$ and $d\Phi_S / dt$ are the derivatives of the flux with respect to time of the primary and secondary windings, respectively.


Primary winding
N_P turns
Secondary winding
N_S turns
Primary current
I_P
Magnetic Flux, Φ
Secondary current
I_S
Primary voltage
V_P
Secondary voltage
V_S
Transformer Core

An idealised step-down transformer showing magnetising flux in the core

we can equate Φ_P and -Φ_S. It thus follows that:

$$\frac{v_P}{v_S} = \frac{N_P}{N_S}$$

where

- V_p and V_s are voltages through the primary inductor and secondary inductor, respectively
- N_p and N_s are the numbers of turns in the primary inductor and secondary inductor, respectively.

These equations cannot be used if both windings are driven by power sources or if the coupling is significantly less than 1.