Shri Shankaracharya Institute of Professional Management & Technology, Raipur

April-May 2021
Class Test-II (August 2021)

Date: 03/08/2021

Student Name: V OM SAI NAGESHWAR SHARMA

Roll No.: 3 0 3 3 0 2 2 2 0 0 2 0

Enrollment No.: B J 4 5 9 9

Course: B.Tech **Semester:** 2nd

Branch: COMPUTER SCIENCE AND ENGINEERING

Subject Name: Basic Electrical And Electronics engineering

Subject Code: A 0 0 0 1 1 3 (0 2 4)

Mobile No.: 8602727389

Email id: om.sharma@ssipmt.com

Signature

Unit-2

Q1)

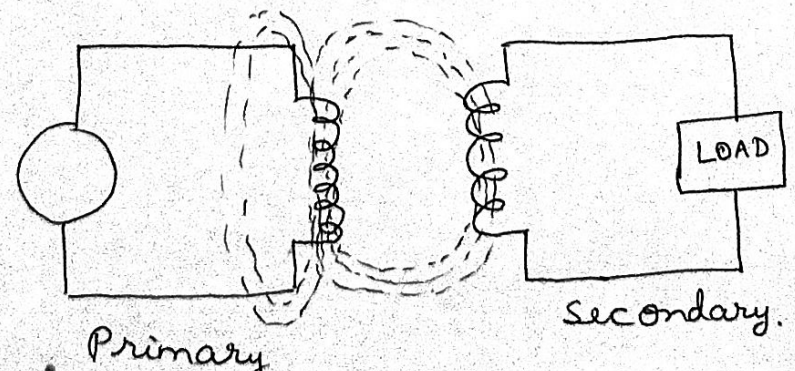
Ans → A transformer is an electrical device that transfers energy from one circuit to another by magnetic coupling with no moving parts.

Principle → (i) A transformer works on the principal of electromagnetic induction.

(ii) By using this principal, which tranfers electrical energy from one winding to another winding by mutual induction between the two windings.

(iii) An alternating flux is ~~et~~ established in the magnetic core when the primary winding is energized from an arc source (VI) and the secondary is open circuited.

(iv) This flux links both the primary and secondary windings, there by an ~~emf~~ emf is induced in them due to the rate change of Flux linkages with the windings.



Core Type	Shell Type
1.) Formed when winding surrounded the core.	Formed when the core surround the winding.
2.) The limitations are cut in the form of L strips.	The limitations are cut in the form of long strips of E & L.
3.) Cross-section of this type may be square, uniform 2 three stepped.	Cross-section of the shell type is regular rectangular in shape.
4.) The flux is equally distributed on the side limbs of the core.	In this the centre of limb carry the whol flux & side limbs carries the half of the flux.
5.) In this the primary & secondary winding are placed on the side limbs.	Primary & secondary windings are placed on the central limb.

Q2>

Ans →

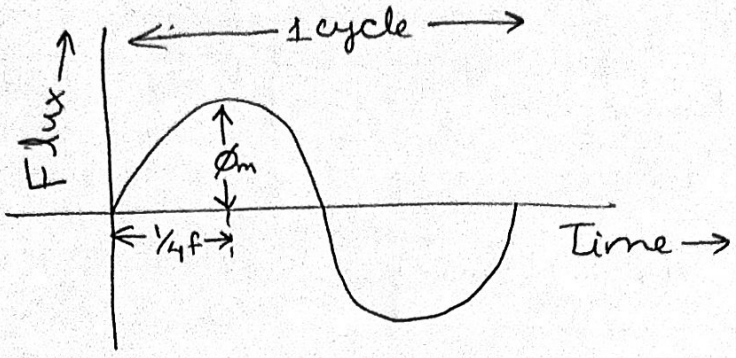


Fig: variation of flux with time

Let N_1 = No. of turns in the primary coil.

N_2 = No. of turns in the secondary coil.

ϕ_m = Maximum flux (Wb) in the core of transformer

f = frequency of A.C. input (Hz)

As the magnetic flux varries sinosidally

$$\phi = \phi_{max} \sin \omega t$$

Basic relationship between induced E.M.F (E) in a coil winding of N turns is given by :-

$$E = N \frac{d\phi}{dt}$$

$$E = N \frac{d}{dt} (\phi_{max} \sin \omega t)$$

$$E = N \phi_{max} \frac{d}{dt} (\sin \omega t)$$

$$E = N \times \phi_{max} \times \omega \times \cos \omega t$$

$$E = N \omega \phi_{max} \cos \omega t.$$

So,

$$E_{max} = N \omega \phi_{max}$$

$$E_{rms} = \frac{E_{max}}{\sqrt{2}} \qquad \left[E_{rms} = \frac{E_m}{\sqrt{2}}\right]$$

$$\boxed{E_{rms} = 4.44\, f.N\, \phi_{max}}$$

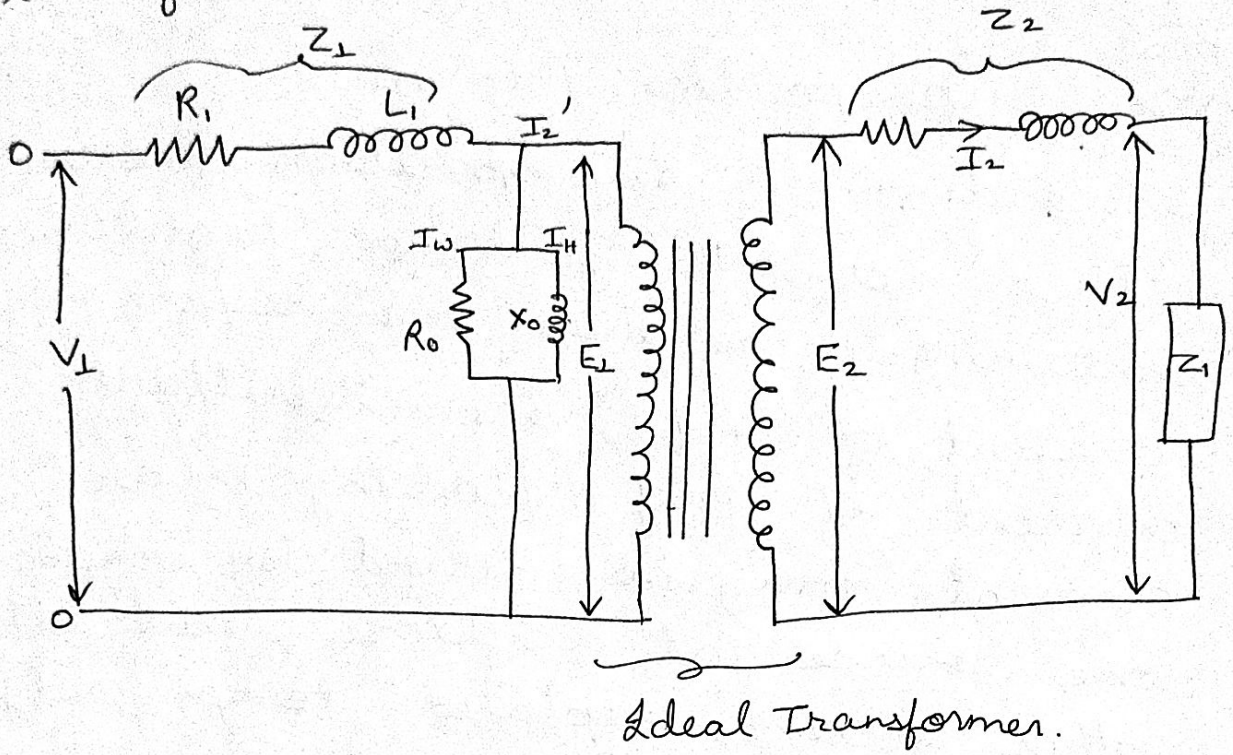
where, f = frequency in (Hz)
N = Number of coil windings.
ϕ = Amount of flux in weber.

→ This is known as the transformer EMF equation. For the primary winding, EMF, N will be number of primary turns ($N_p = N_1$) and for the secondary winding Emf, N will be the number of secondary turns ($N_s = N_2$).

$$N_p = 4.44\, f\, N_1\, \phi_{max}.$$
$$N_s = 4.44\, f\, N_2\, \phi_{max}.$$

→ Equivalent ~~cir~~ circuit diagram of a transformer is basically a diagram which can be resolved into an equivalent circuit in which the resistance and leakage reactance of the transformer are imagined to be external to the winding.

The equivalent circuit diagram of transformer is given below :-



where,

R_1 = Primary winding Resistance.

R_2 = Secondary winding Resistance.

I_0 = No-load current.

I_H = Magnetizing Component.

I_w = Working Component.

Unit - 1

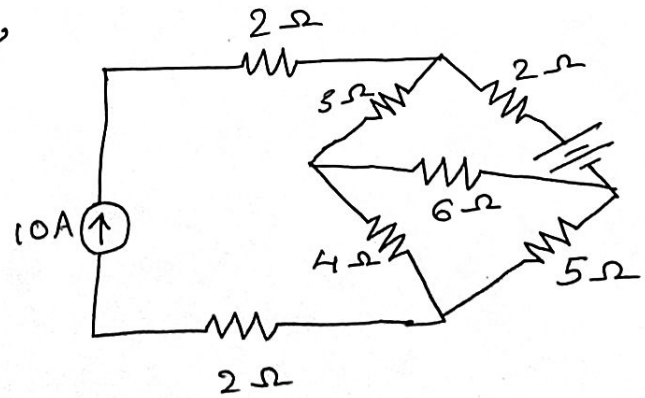
Q2>

Ans => Superposition Theorem :-

According to superposition theorem - "In a network of linear registors, containing more than one source (current of emf), the resultant current of emf flowing in an element may be found by considering one source at a time, and all other sources replaced temporarily by their internal resistances; followed by adding the currents / emfs due to the individual sources".

* Voltage sources are replaced by short circuit of their internal resistance
* Current sources are replaced by open circuit of their internal resistance.

Now,

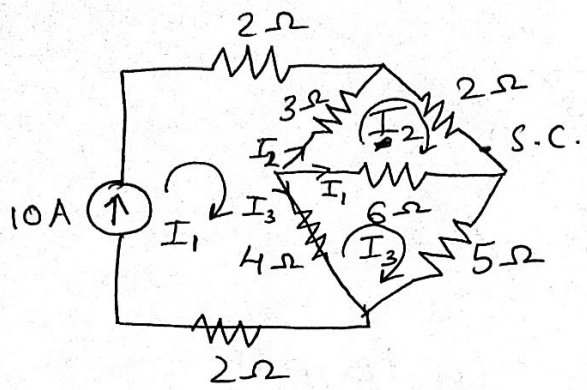


Solving this circuit using superposition Theorem -

Pg. No. → 6

Step 1:

When 10 A current source are alone. then voltage source replaced by short circuit.



Here, $I_1 = 10\,A$ (Given)

Applying KVL in loop (2) —

$$-2I_2 - 6(I_2 - I_3) - 3(I_2 - I_1) = 0$$

$$-2I_2 - 6I_2 + 6I_3 - 3I_2 + 3I_1 = 0$$

$$-11I_2 + 6I_3 + 30 = 0 \quad (\because I_1 = 10\,A) \quad —①$$

Now,

Applying KVL in loop ① —

$$6I_2 - 15I_3 = -40 \quad —②$$

Solving eqⁿ ① & ②

$$-11I_2 + 6I_3 + 30 = 0 \quad \times 6$$

$$6I_2 - 15I_3 + 40 = 0 \quad \times 11$$

$$\Rightarrow \boxed{I_3 = 4.80\,A}$$

in Eqⁿ. ① $\longrightarrow$ $11(I_2) + 6(4.80) + 30 = 0$

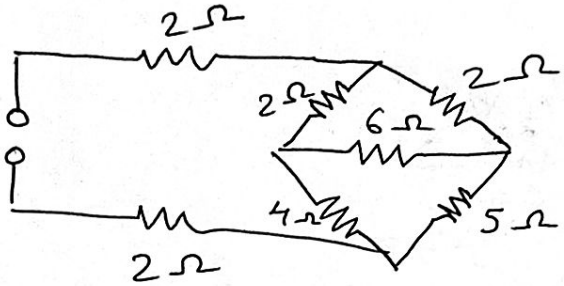
$$\boxed{I_2 = 5.34\,A}$$

So, $I' = I_3 - I_2 = 4.80 - 5.34 = -0.54\,A$

$$\boxed{I' = -0.54\,A}$$

Step II :

when 20V is alone, then current source replaced by open circuit.



Applying KVL in loop ① —

$$20 - 2I_1 - 2I_1 - 6I_1 + 6I_2 = 0$$

$$20I_1 - 6I_2 = 20 \quad — ①$$

KVL in loop ① —

$$-5I_2 - 4I_2 - 6I_2 + 6I_1 = 0$$

$$6I_1 - 15I_2 = 0 \quad — ②$$

Solving Eq^n ① and ② —

$$(10I_1 - 6I_2 = 20) \times 6$$
$$(6I_1 - 15I_2 = 0) \times 10$$

$$\Rightarrow \quad 60I_1 - 36I_2 = 120$$
$$60I_1 - 150I_2 = 0$$

$$114I_2 = 120 \Rightarrow \boxed{I_2 = 1.05A}$$

in Eq^n ① —

$$10(I_1) - 6I_2 = 20$$
$$10I_1 - 6(1.05) = 20$$
$$\Rightarrow \boxed{I_1 = 2.63A}$$

So, $I'' = I_1 + I_2$

$I'' = 1.05 + 2.63 = 3.68\ A.$

Now,

Total current $I = I' + I''$

$I = -0.54 + 3.68$

$\boxed{I = 3.14A}$ Ans

Q3>

Ans → (i) Difference B/w Electric and Magnetic circuit.

Electric circuit	Magnetic circuit
① In an electrical circuit, electric current flows through the closed path.	In the magnetic circuit, magnetic flux flows through the closed path.
② Electric current is measured in Ampere (A)	Magnetic flux is measured in weber (Wb).
③ In an electrical ckt, electric current flows from positive to negative polarities.	In the magnetic circuit, magnetic flux from N-pole to S-pole.

~~Ans~~ → (ii) Let B be the flux density in the iron ring. Its value would ~~be~~ also be the same in the air gap.

First consider iron ring :-

$$H_1 = B/(\mu_0)(\mu_r)$$

$$= \frac{B}{4\pi \times 10^{-7} \times 300}$$

$$= \frac{B}{3.8 \times 10^{-4}}$$

$$= 2653.92\ B.$$

$$l_1 = 70\,cm = 0.7\,m.$$

$\Rightarrow$ mmf across iron ring $F_1 = H_1 l_1$

$$= 2653.92 \times 0.7$$

$$= 1857.74\ B.$$

Now consider air gap,

$$H_2 = B/\mu_0 = B / 4\pi \times 10^{-7}$$

$$= 7.96 \times 10^5 B.$$

$$l_2 = 0.003\,m.$$

$\Rightarrow$ mmf across air gap $F_2 = H_2 l_2$

$$\Rightarrow F_2 = 7.96 \times 10^5 \times 0.003.$$

$$= 2388.$$

Total mmf $F = F_1 + F_2$

$$= 4245.74.$$

But total given mmf ~~F~~ $F = N.I.$

$$= 200 \times 1$$

$$= 200$$

$$\Rightarrow B = \frac{200}{4245.7} = 0.0471\ Wb/m^2$$