28th Dec

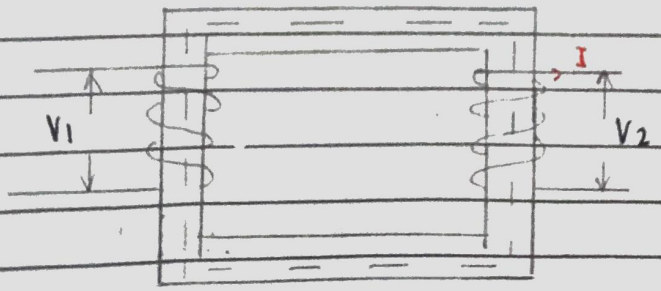
Test on transformer

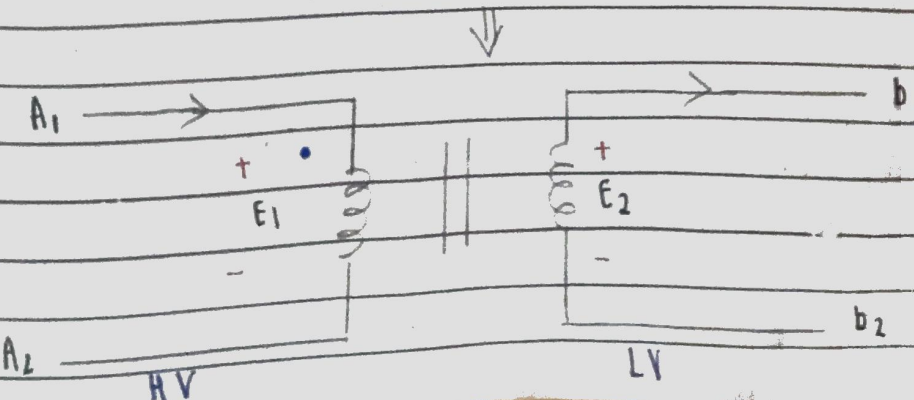
i) Polarity test
ii) Open circuit test / No load test
iii) Short circuit test.

i) Polarity test

Dot convention are used to indicate the polarity.

- It gives the voltage polarity at the dotted terminal
  - I enter or leave doesn't matter
- It is assumed that
  dotted terminal → +ve





Note: HV → High voltage winding (capital) → A_1, A_2

LV → low voltage winding (small) → b_1, b_2

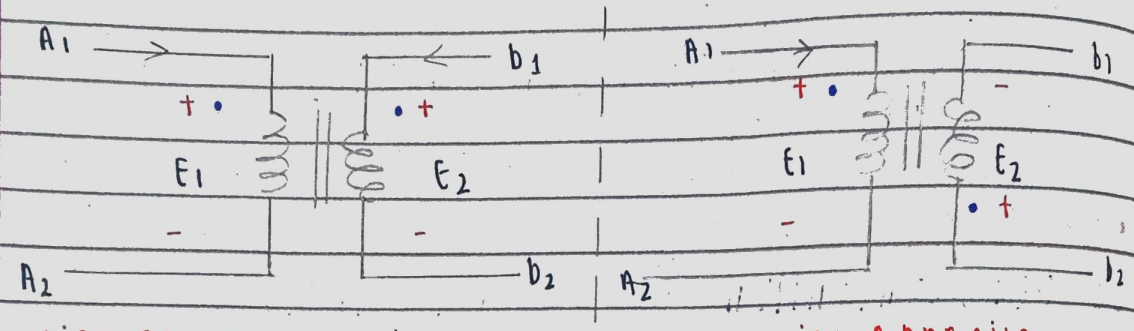
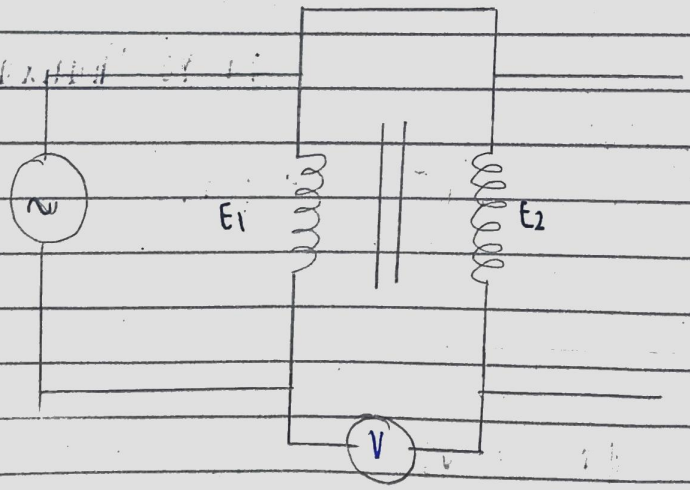


Fig: same polarity

Fig: opposite polarity

• Circuit



Two windings are connected in series across a voltmeter.

While,

one winding is excited by suitable voltage source as shown in fig

(a) Case I:

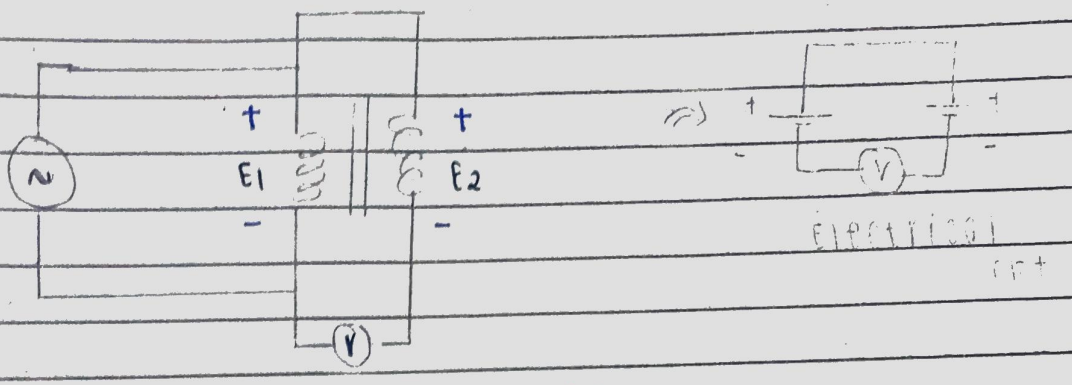


Fig: same polarity

- Voltmeter reading
  - $E_1 - E_2$

(b) Case II:

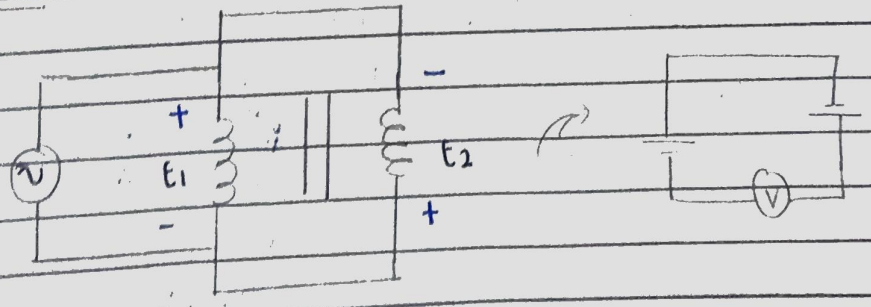
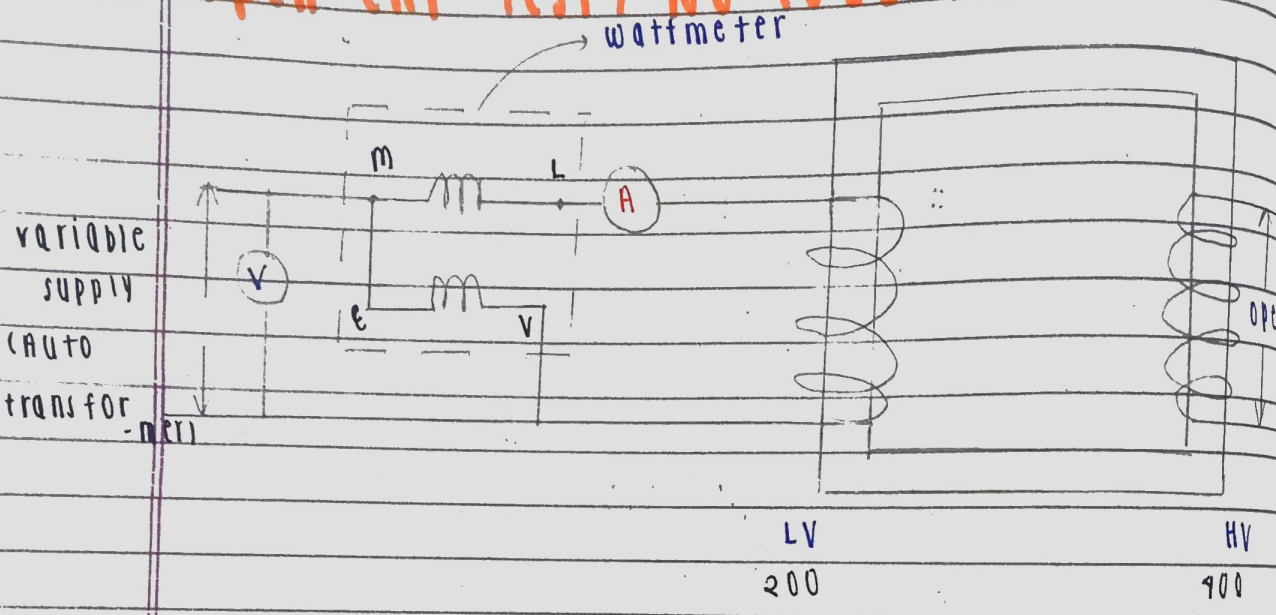


Fig: opp polarity

- Voltmeter reading
  - $E_1 + E_2$

iii) open cct Test / no load test



- purpose:

  Is to obtain:

  a) shunt branch parameter
  magnetizing (components)
  R_0 ✓
  X_0

  b) no load power loss
  (iron loss)

  c) no load power factor
  ($\cos \phi_0$)

Note: Transformer KO rating $\frac{200}{900}$ ~ 10 KO

200 → LV

400 → HV

20 KO

Procedure

usually, • ammeter
• voltmeter
& • wattmeter
} are connected on low voltage side

↓

to measure:
• no load current
• applied voltage
& • power consumed.

The high voltage side ⟶ kept open

Gradually,
the supply voltage is varied till the voltmeter (V) shows the rated voltage of that side
↳ i.e. 200V

let,
W_o = wattmeter reading
I_o = ammeter reading
V_1 = voltmeter reading

We know that,
$W_o = V_1 I_o \cos\phi_o$

$$\therefore \cos\phi_0 = \frac{W_0}{V_1 I_0}$$

$$\phi_0 = \cos^{-1}\left(\frac{W_0}{V_1 I_0}\right)$$

$$I_e = I_0 \cos\phi_0$$

$$I_m = I_0 \sin\phi_0$$

we know,

$$V = IR$$

$$\therefore R = \frac{V}{I}$$

$$R_0 = \frac{V_1}{I_0} \qquad X_0 = \frac{V_1}{I_m}$$

• Equivalent ckt of transformer on no load test

sabai in ref. to primary

so,

$$R_{01} = R_1 + \frac{R_2}{K^2}$$

→ 2° lai 1° lagne vaye ÷ by K^2

$$X_{01} = X_1 + \frac{X_2}{K^2}$$

↓

1° to 2° vo vaye × by K^2

as $I_2 = 0$ since ckt is open

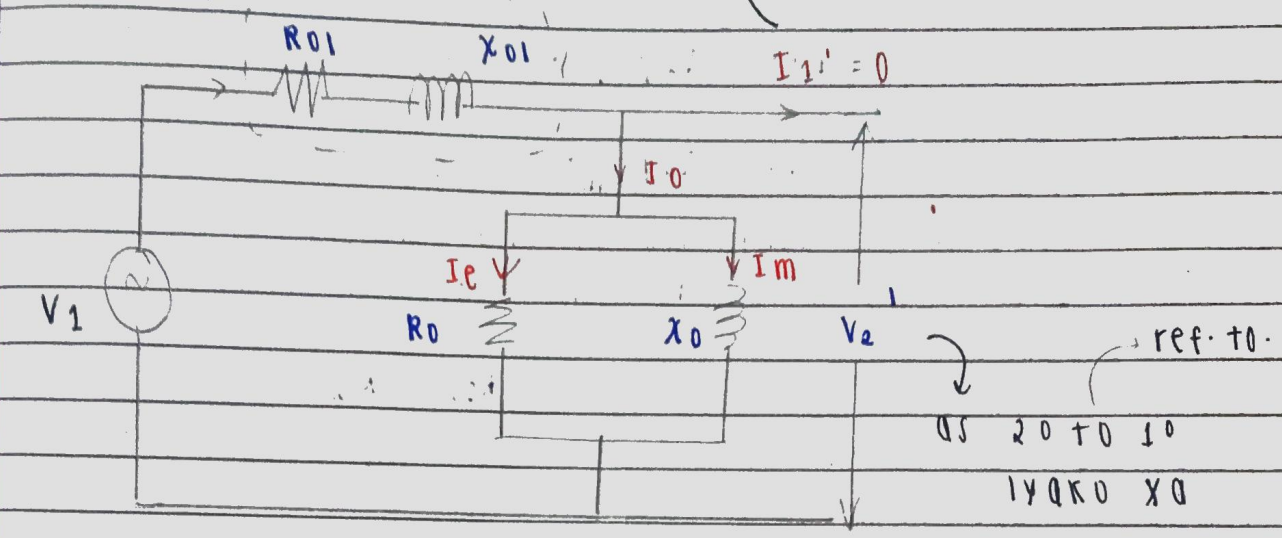


Fig: Equivalent ckt of transformer referred to primary

Note:

400/200 ⇒ step down xo vane

all
- ammeter
- wattmeter
- voltmeter

connected in 2° side

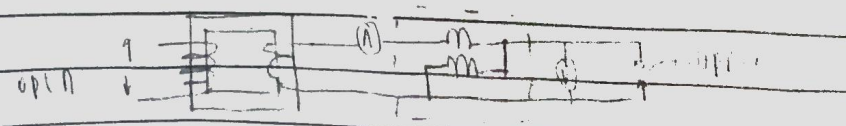
↳ 1° side remains open

↓

W_0, I_0, V_1 same

↓

$W_0 = V_2 I_0 \cos\phi_0$



Tara in ref to 2° xa so

$$I_m' = I_0 \sin\phi_0$$

$$I_e' = I_0 \cos\phi_0$$

similarly,

$$R_0' = V_2 / I_e'$$

$$X_0' = V_2 / I_m'$$

Ya actually ma primary ko ho but its ref. to 2°

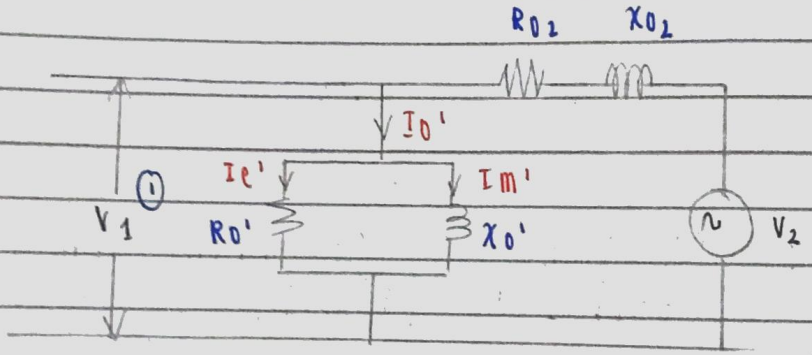


Fig: Equivalent ckt ref. to 2°