1. The number of primary and secondary windings is 80 and 120 respectively. The secondary voltage is given by 240V, determine the primary voltage.

Np = 80
Ns = 120
Vs = 240V
The transformer formula is given by,
Vp / Vs = Np / Ns
Vp = Np / Ns × Vs
= 80 / 120 x 240
Vp = 160 V

2. The number of primary and secondary windings is 60 and 100 respectively. The secondary voltage is given by 250V, determine the primary voltage.

Ns = 100
Vs = 250V
The transformer formula is given by,
Vp / Vs = Np / Ns
Vp = Np / Ns × Vs
= 60 / 100 x 250
Vp = 150 V

3. The number of primary and secondary windings is 110 and 240 respectively. The primary voltage is given by 300V, which determines the secondary voltage.

Np = 110
Ns = 240
Vp = 300V
The Transformer Formula is Given By,
Vp/Vs = Np/Ns
Vs = Ns/Np × Vp
Vs = 240/110 × 300

4. A transformer has **500** primary turns and **3000** secondary turns. If the primary voltage is **240 V**,determine the Secondary voltage, assuming an ideal transformer.

For an ideal transformer, voltage ratio = turns ratio, i.e.

$$\frac{V_1}{V_2} = \frac{N_1}{N_2}, hence\ \frac{240}{V_2} = \frac{500}{3000}$$

$$Thus\ secondary\ voltage\ V_2 = \frac{(3000)\,(240)}{(500)} = 1440\ V\ or\ 1.44\ kV$$

5. An ideal transformer with a turns ratio of **2:7** is fed from a **240 V** supply. Determine its outputvoltage.

A turn's ratio of 2:7 means that the transformer has ***2 turns on the primary*** for ***every 7 turns on thesecondary*** (i.e. a step – up transformer). Thus,

$$\frac{N_1}{N_2} = \frac{2}{7}$$

$$For\ an\ ideal\ transformer, \frac{N_1}{N_2} = \frac{V_1}{V_2}\ ; nence\ \frac{2}{7} = \frac{240}{V_2}$$

$$Thus\ the\ secondary\ voltage\ V_2 = \frac{(240)\ (7)}{(2)} = 840\ V$$

6. An ideal transformer has a turns ratio of **8:1** and the Primary current **3 A** when it is supplied at **240v.**Calculate the secondary voltage and current.

$$\boldsymbol{A\ turns\ ratio\ of\ 8{:}\,1\ means\ \frac{N_1}{N_2} = \frac{8}{1}, i.e.\,a\ step - down\ transformer.}$$

$$\boldsymbol{\frac{N_1}{N_2} = \frac{V_1}{V_2}\ or\ secondary\ voltage\ V_2 = V_1\left(\frac{N_2}{N_1}\right) = 240\left(\frac{1}{8}\right) = 30\ Volts}$$

7. An ideal transformer, connected to ***240 V mains***, supplies a ***12 V, 150 W lamp***. Calculate the transformer turns ratio and the current taken from the supply.

$$V_1 = 240V, V_2 = 12V, I_2 = \frac{P}{V_2} = \frac{150}{12} = 12.5\ A$$

$$Turns\ ratio = \frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{240}{12} = 20$$

$$\frac{V_1}{V_2} = \frac{I_2}{I_1}, from\ which, I_1 = I_2\left(\frac{V_2}{V_1}\right) = 12.5\left(\frac{12}{240}\right)$$

$$Hence\ current\ taken\ from\ the\ supply, I_1 = \frac{12.5}{20} = 0.625\ A$$

8. ***A 5-kVA single-phase transformer*** has a ***turns ratio of 10:1*** and is fed from ***a 2.5 kV supply***. Neglecting losses, determine:

a) the full-load secondary current.

b) the minimum load resistance which can be connected a cross the secondary winding to give full load kVA.

c) the primary current at full load kVA.

$$\frac{N_1}{N_2} = \frac{10}{1} \; and \; V_1 = 2.5\, kV = 2500\, V$$

$$Since \; \frac{N_1}{N_2} = \frac{V_1}{V_2}, secondary\ voltage$$

$$V_2 = V_1 \left(\frac{N_2}{N_1}\right) = 2500 \left(\frac{1}{10}\right) = 250\, V$$

$$The\ transformer\ rating\ in\ volt - amperes = V_2\, I_2\ (at\ full\ load), i.e. 5000 = 250\, I_2$$

$$Hence\ full\ load\ secondary\ current\ I_2 = \frac{5000}{250} = 20\ A$$

$$Minimum\ value\ of\ load\ resistance, R_L = \frac{V_2}{I_2} = \frac{250}{20} = 12.5\Omega$$

$$\frac{N_1}{N_2} = \frac{I_2}{I_1}, from\ which\ primary\ current, I_1 = I_2 \left(\frac{N_2}{N_1}\right) = 20 \left(\frac{1}{10}\right) = 2\ A$$

9. A **100 kVA, 4000 V/200 V, 50 Hz** single-phase transformer has**100** secondary turns. Determine

a) The primary and secondary current.

b) The number of primary turns.

c) The maximum value of the flux.

V_1 = 400V, V_2 = 200 V, f = 50 Hz, N_2 = 100 turns

a) Transformer rating = $V_1 * I_1 = V_2 * I_2$ = 100000 VA

hence primary current, $I_1 = \frac{100000}{V_1} = \frac{100000}{4000} = 25\ A$

and secondary Current, $I_2 = \frac{100000}{V_2} = \frac{100000}{200} = 500\ A$

from which, primary turns, $N_1 = \left(\frac{V_1}{V_2}\right)(N_2) = \left(\frac{4000}{200}\right)(100)$

b) i.e., N_1 = 2000 turns

c)

$$from\ which, maxmimum\ flux\ \Phi_m = \frac{E_2}{4.44\ f\ N_2} = \frac{200}{4.44\ (50)\ (100)}$$

(assuming $E_2 = V_2$)

$$\phi_m = 9.01 * \ 10^{-3}\ Wb\ or\ 9.01\ mWb$$

Where $E_1 = 4.44 f\, \Phi_m\, N_1$

From which, $\phi_m = \frac{E_1}{4.44\ f\ N_1} = \frac{4000}{4.44\ (50)\ (2000)}$

(assuming $E_1 = V_1$)

$$\phi_m = 9.01 * \ 10^{-3}\ Wb\ or\ 9.01\ mWb$$

10. A single-phase ***500 V/100 V, 50 Hz*** transformer has a maximum core flux density of ***1.5 T*** and an effective core cross-sectional area of ***50 cm2***. Determine the number of primary and secondary turns.

The e.m.f. Equation for a transformer is $E = 4.44\, f\, \phi_m N$

And maximum flux, $\phi_m = B * A = (1.5)\,(50 * 10^{-4}) = 75 * 10^{-4}\, Wb$

Since $E_1 = 4.44\, f\, \phi_m N_1$

Then primary turns, $N_1 = \frac{E_1}{4.44\, f\, \emptyset_m} = \frac{500}{4.44\,(50)\,(75 * 10^{-4})} = 300\ turms$

Since $\boldsymbol{E_2 = 4.44\, f\, \phi_m N_2}$

Then secondary turns, $N_2 = \frac{E_2}{4.44\, f\, \emptyset_m} = \frac{500}{4.44\,(50)\,(75 * 10^{-4})} = 60\ turms$

11. **A 4500 V/225 V, 50 Hz** single-phase transformer is to have an approximate e.m.f. per turn of **15 V** and operate with a maximum flux of **1.4 T**. Calculate

a) The number of primary and secondary turns.

b) The cross-sectional area of the core.

a) $E.m.f.per\ turn = \frac{E_1}{N_1} = \frac{E_2}{N_2} = 15$

$Hence\ primary\ turns, N_1 = \frac{E_1}{15} = \frac{4500}{15} = 300$

$and\ secondary\ turns, N_2 = \frac{E_2}{15} = \frac{225}{15} = 15$

b) *E.m.f.* $E_1 = 4.44\, f\, \phi_m N_1$

$from\ which, \Phi_m = \frac{E_1}{4.44\, f\, N_1} = \frac{4500}{4.44\,(50)\,(300)} = 0.0676\, Wb$

$Now\ flux\ \phi_m = B_m * A, where\ A\ is\ the\ cross - Sectional\ area\ of\ the\ core, hence$

$area\ A = \frac{\phi_m}{B_m} = \frac{0.0676}{1.4} = 0.0483\ m^2\ or\ 483\ cm^2$

12. A transformer rated at a primary voltage 4,800 volts and a secondary voltage of 240 volts what is the turn's ratio?

$$\frac{N_1}{N_2} = \frac{4800}{240} = 20 : 1$$