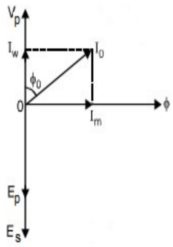
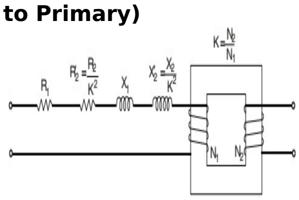
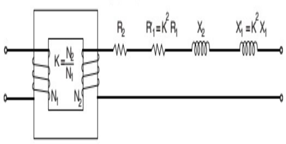
Parameter	Symbol / Formula	Where
Primary EMF Equation of Single Phase Transformer (E_p)	$E_p = 4.44 \cdot f \cdot N_p \cdot \Phi$	f= frequency N_p =Number of primary turns Φ = maximum flux
Secondary EMF Equation (E_s)	$E_s = 4.44 \cdot f \cdot N_s \cdot \Phi$	f= frequency N_s =Number of secondary turns Φ = maximum flux
Transformation ratio (K)	${\frac{N_s}{N_p} = \frac{V_s}{V_p}=\frac{I_p}{I_s}=K}$	N_s =Number of secondary turns N_p =Number of primary turns V_p =Primary voltage V_s =Secondary voltage
Turn Ratio	$\frac{N_p}{N_s} = \frac{V_p}{V_s}$	N_s =Number of secondary turns N_p =Number of primary turns V_p =Primary voltage V_s =Secondary voltage
No load Primary Current (I_0)	$I_0=\sqrt{I_m^2+I_w^2}$ 	I_m= Magnetising Component I_w=Active or Working or Iron loss component
Active or Working or Iron loss component (I_w)	$I_w=I_0\cos{\phi_0}$	${\phi_0}$= Angle between V_p and I_0
Magnetising Component (I_m)	$I_m=I_0\sin{\phi_0}$	${\phi_0}$= Angle between V_p and I_0
Impedance Ratio	$\frac{Z_1}{Z_2}=K^2$ $\frac{R_2}{R_1}=K^2$ $\frac{X_2}{X_1}=K^2$	Z_2= Secondary Impedance Z_1 = Primary Impedance
Shifting in a Transformer (Referred to Primary) 	$R_{01} = R_1 + R_2' = R_1 + \frac{R_2}{K^2}$ $X_{01} = X_1 + X_2' = X_1 + \frac{X_2}{K^2}$ $Z_{01} = \sqrt{R_{01}^2 + X_{01}^2}$ $V_2'=\frac{V_2}{K}$ $I_2'={I_2}{K}$	R_{01}= Equivalent resistance referred to primary X_{01}= Equivalent reactance referred to primary Z_{01}=Equivalent impedance referred to primary R_2'=Secondary resistance referred to primary X_2'=Secondary reactance referred to primary V_2'= Secondary voltage referred to primary I_2'= Secondary current referred to primary
Shifting in a Transformer (Referred to Secondary) 	$R_{02} = R_2+ R_1' = R_2 + {R_1}{K^2}$ $X_{02} = X_2 + X_1' = X_2 + {X_1}{K^2}$ $Z_{02} = \sqrt{R_{02}^2 + X_{02}^2}$ $V_1'={V_1}{K}$ $I_1'=\frac{I_1}{K}$	R_{02}= Equivalent resistance referred to secondary X_{02}= Equivalent reactance referred to secondary Z_{02}=Equivalent impedance referred to secondary R_1'=Primary resistance referred to secondary X_1'=Primary reactance referred to secondary V_1'= Primary voltage referred to secondary I_1'= Primary current referred to secondary

Parameter	Symbol / Formula	Where
Percentage Voltage Regulation	1) $\%Reg_{down} = \frac{V_{nl} - V_{fl}}{V_{nl}} \times 100\%$ 2) $\%Reg_{up} = \frac{V_{nl} - V_{fl}}{V_{fl}} \times 100\%$ ***** (1) No. equation is generally used	V_{nl}= No load secondary voltage V_{fl}= Full load secondary voltage ****** **Voltage regulation-down (Reg_{down}):** This happens when the secondary transformer terminal's voltage output decreases due to a load attached to it. **Voltage regulation-up (Reg_{up}):** This occurs when the secondary terminal of the transformer experiences an increase in voltage upon removal of the load.
Voltage Regulation for lagging and leading	**For lagging p.f** $V_{nl} - V_{fl} = I_2R_{02}\cos\varphi_2 + I_2X_{02}\cos\varphi_2$ **For lagging p.f** $V_{nl} - V_{fl} = I_2R_{02}\cos\varphi_2 - I_2X_{02}\cos\varphi_2$	R_{02}= Equivalent resistance referred to secondary X_{02}= Equivalent reactance referred to secondary
Power (Ideal Transformer)	$P_p = P_s$ or $V_p \cdot I_p = V_s \cdot I_s$	(P_p) and (P_s) are the primary and secondary powers, (V_p, V_s) are the voltages, (I_p, I_s) are the currents.
Copper Loss (P_{cu})	$P_{Cu} = I_p^2 R_p + I_s^2 R_s$	I_p ,I_s are the currents, R_p, R_s are the resistances of primary and secondary windings
Core Loss or Iron loss	$P_i = P_{h} + P_{e}$	Pi = Total core loss P_h = Hysteresis loss P_e =eddy current loss
Total losses in Transformer	Total losses = P_i +P_{Cu} = Constant Loss + Variable Loss	P_i = Total core loss or Constant loss P_{Cu}= Copper loss or Variable loss
Hysteresis loss (in watts) (P_h)	$P_h = \eta B_{\text{max}}^{x} f V$	η = Steinmetz hysteresis coefficient (depends on the material) B_{max} = Maximum flux density in the core f= Frequency of the magnetic field (in hertz) v= Volume of the core (in cubic meters)
Eddy current loss (in watts) (Pe)	$P_e=k_e\ B_{\max}^2f^2t^2v$	k_e = Constant that depends on the material's resistivity and geometry B_{max} = Maximum magnetic flux density (in teslas) f = Frequency of the magnetic field t = Thickness of the core laminations (in meters) v = Volume of the core (in cubic meters)
Efficiency (η)	$\eta = \frac{P_{out}}{P_{in}} \times 100\%$ $\eta=\frac{P_{out}}{P_{out}+Losses}\times 100\%$	P_{out} = Output power, P_{in} = Input power.