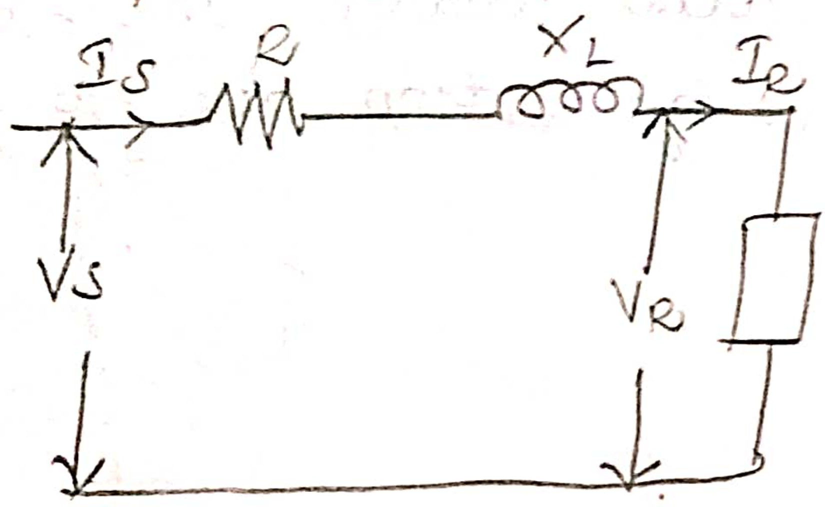
## Short Tr. line




capacitance is neglected.

Resistance & Inductance are considered

$$V_S = V_R + I_R R + j I_R X_L \quad \text{——} \ (1)$$

$$V_S = V_R + I_R Z$$

$$I_S = I_R \quad \text{——} \ (2)$$

Eq (1) & (2) in matrix form

$$\begin{bmatrix} V_S \\ I_s \end{bmatrix} = \begin{bmatrix} 1 & Z \\ 0 & 1 \end{bmatrix} \begin{bmatrix} V_R \\ I_R \end{bmatrix}$$

$V_S$ - Sending end phase voltage

$I_S$ - " " " current

$V_R$ - Receiving " " voltage

$I_R$ - " " " current

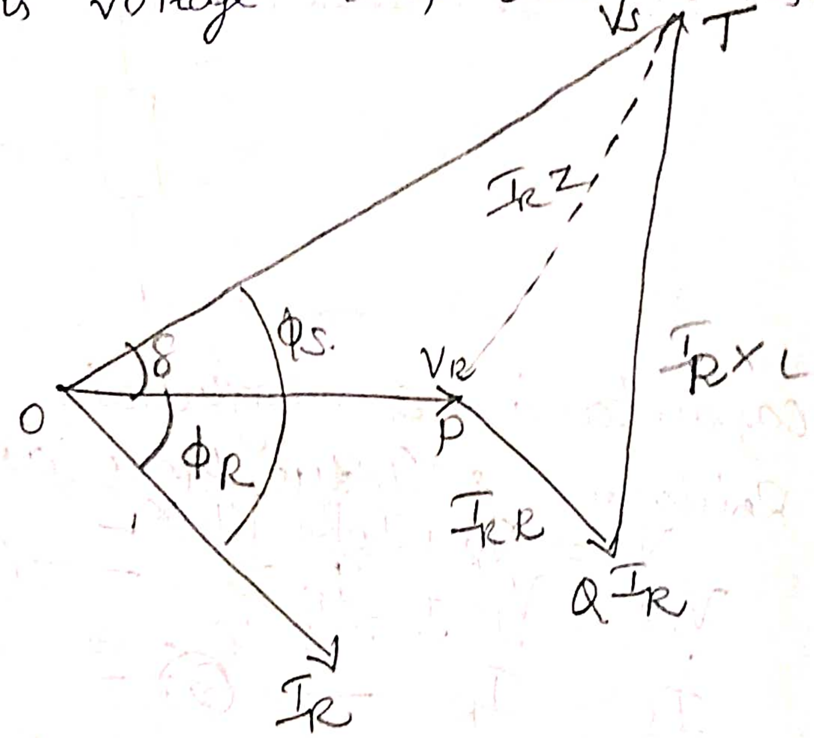
$Z = R + jX_L$ series impedance

R - loop resistance, $X_L$ = inductive Loop reactance

## Lagging power factor load

Assume $V_R$ as a reference vector, draw a line OP.

Draw $I_R$ with lags $V_R$ by angle $\phi_R$.
At P draw parallel line to $I_R$.
PQ is voltage drop due to resistance $I_R$

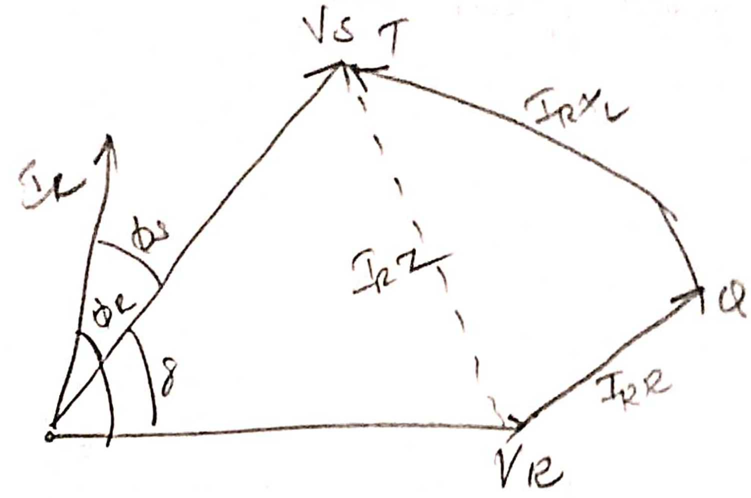



With Q as centre draw a 90° line which gives voltage drop due to inductive reactance $I_RX_L$ i.e QT.

PT gives voltage drop due to impedance $I_RZ$.

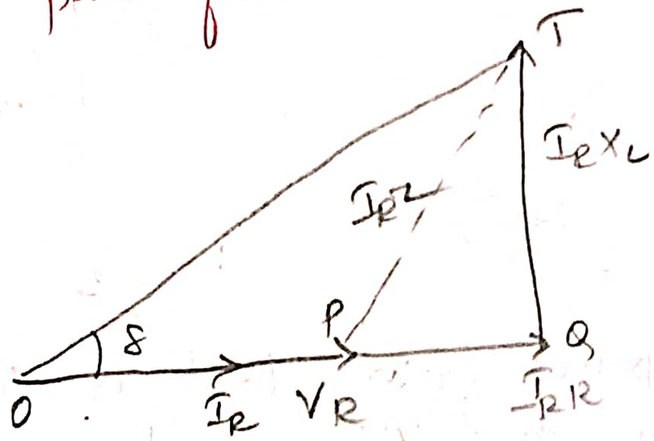
Join OT which gives sending end phase voltage $V_S$ and δ give the load angle.

Leading power factor load.




$I_R$ leads $V_R$ by an angle $\phi_R$

Unity power factor load.




$I_R$ is phase with $V_R$.

$\cos\phi = 1$

$\phi = 0 = \phi_R$

$\cos\phi_R =$ unity

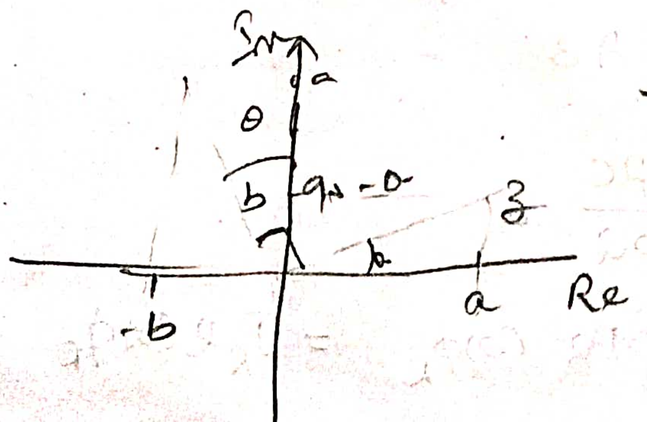
$\cos\phi_s =$ lagging.

$Z = a + jb$

$jz = j(a + jb)$

$jz = ja - b.$

$= -b + ja$




$\theta + 90° - \theta$

$= 90°$