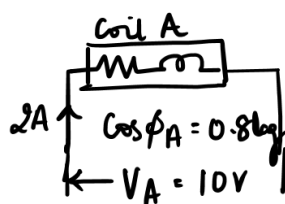


Lecture 28

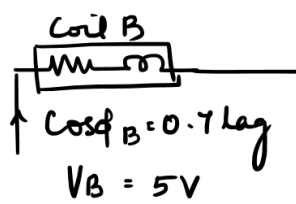
2. A coil A takes a current of 2A at a power factor of 0.8 lagging when applied voltage is 10V. A second coil B takes a current of 2A at a power factor of 0.7 lagging when applied voltage is 5V. What voltage will be required to produce a total current of 2A when coils A and B are connected in series? Find the power factor in this case. Consider supply frequency to be same in all cases.



$$Z_A = \frac{V_A}{I} = \frac{10}{2}$$

$$\phi_A = 36.86^\circ$$

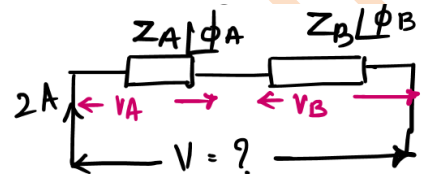
$$Z_A \angle \phi_A = 5 \angle 36.86^\circ$$



$$Z_B = \frac{V_B}{I} = \frac{5}{2}$$

$$\phi_B = 45.57^\circ$$

$$Z_B \angle \phi_B = 2.5 \angle 45.57^\circ$$



$$V = I Z_T \angle \phi$$

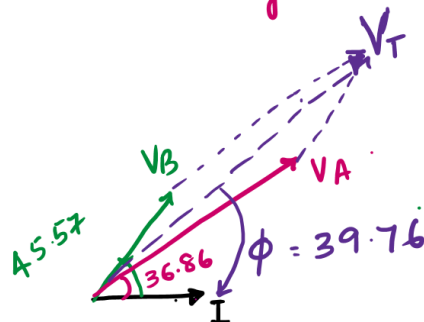
$$\begin{aligned} Z_T \angle \phi &= Z_A \angle \phi_A + Z_B \angle \phi_B \\ &= 5 \angle 36.86^\circ + 2.5 \angle 45.57^\circ \\ &= 7.48 \angle 39.76^\circ \end{aligned}$$

$$V = 2 \times 7.48 \angle 39.76^\circ$$

$$V = 14.96 \angle 39.76^\circ$$

$$V = 11.90 + j9.56 \text{ (Rect)}$$

Phasor diagram



I lags V by 39.76°

$$V_A = 10 \angle 36.86^\circ$$

$$V_B = 5 \angle 45.57^\circ$$

$$V_T = 14.96 \angle 39.76^\circ$$

$$I = 2 \angle 0^\circ \text{ (ref)}$$

$$\begin{aligned} \vec{V} &= \vec{V}_A + \vec{V}_B \\ &= 10 \angle 36.86^\circ + 5 \angle 45.57^\circ \\ V \angle \phi &= 14.96 \angle 39.76^\circ \end{aligned}$$