Lecture 42

2. It is observed that second phase current in a balanced delta system is $10\sin(\omega t-60^{o})$A.Express all the three phase currents and all the three line currents in both time form and phasor form.

Solution:

Let Phase currents be $i_1, i_2, \& i_3$

Line currents be i_R, i_Y, i_B

Given that 2nd phase current is

$$i_2(t) = 10\sin(\omega t - 60^{\circ})A$$

Other phase currents are

$$i_1(t) = 10\sin(\omega t - 60^{\circ} + 120^{\circ})$$

$$= 10\sin(\omega t + 60)A$$

(1st phase current leads 2nd phase current by 120°)

$$i_3(t) = 10\sin(\omega t - 60^{\circ} - 120^{\circ})$$

$$= 10\sin(\omega t - 180^{\circ})$$

(3rd phase current lags 2nd phase current by 120°)

Line currents

$$i_R(t) = \sqrt{3} \times 10 \sin(\omega t + 60^\circ - 30^\circ)$$

$$= 17.3 \sin(\omega t + 30)\,A$$

1st line current is $\sqrt{3}$ I_{ph} & lags 1st phase current by 30°

Similarly

$$i_Y(t) = \sqrt{3} \times 10 \sin(\omega t - 60^\circ - 30^\circ)$$

$$= 17.3 \sin(\omega t - 90^\circ)\,A$$

2nd line current lags 2nd phase current by 30°

$$i_B(t) = \sqrt{3} \times 10 \sin(\omega t - 180^\circ - 30^\circ)$$

$$= 17.3 \sin(\omega t - 210^\circ)\,A$$

Phasor forms of currents

Phase Currents

$$\vec{I}_1 = \frac{10}{\sqrt{2}} \angle 60^\circ$$

$$\vec{I}_2 = \frac{10}{\sqrt{2}} \angle -60^\circ$$

$$I_3 = \frac{10}{\sqrt{2}} \angle -180^\circ$$

Phase voltages

$$\bar{I}_R = \frac{17.3}{\sqrt{2}} \angle 30^\circ$$

$$\bar{I}_Y = \frac{17.3}{\sqrt{2}} \angle -90^\circ$$

$$\vec{I}_B = \frac{17.3}{\sqrt{2}} \angle -210^\circ$$