NOTES -Class 22

Numerical Examples

1.The following three sinusoidal currents flow into the junction i1 = 3√2 sin ωt,i2 = 5√2 sin (ωt + 30°) and i3 = 6√2 sin (ωt – 120°). Find the expression for the resultant current which leaves the junction.

Solution

Data

$$i_1 = 3\sqrt{2} \sin \omega t$$
$$i_2 = 5\sqrt{2} \sin (\omega t + 30°)$$
$$i_3 = 6\sqrt{2} \sin (\omega t - 120°)$$

Writing currents i_1, i_2 and i_3 in the phasor form,

$$\overline{I_1} = \frac{3\sqrt{2}}{\sqrt{2}} \angle 0° = 3\angle 0°$$

$$\overline{I_2} = \frac{5\sqrt{2}}{\sqrt{2}} \angle 30° = 5\angle 30°$$

$$\overline{I_3} = \frac{6\sqrt{2}}{\sqrt{2}} \angle -120° = 6\angle -120°$$

The resultant current which leaves the junction is given by

$$\overline{I} = \overline{I_1} + \overline{I_2} + \overline{I_3} = 3\angle 0° + 5\angle 30° + 6\angle -120°$$
$$= 5.1 \angle -31.9°$$
$$i = 5.1\sqrt{2} \sin (\omega t - 31.9°) = 7.21 \sin (\omega t - 31.9°)$$

2.Find the resultant voltage and its equation for the given voltages

$$e_1 = 20 \sin \omega t, \qquad e_2 = 30 \sin \left(\omega t - \frac{\pi}{4} \right), \qquad e_3 = 40 \cos \left(\omega t + \frac{\pi}{6} \right)$$

Solution

Data

$$e_1 = 20 \sin \omega t$$

$$e_2 = 30 \sin\left(\omega t - \frac{\pi}{4}\right) = 30 \sin(\omega t - 45°)$$

$$e_3 = 40 \cos\left(\omega t + \frac{\pi}{6}\right) = 40 \sin(\omega t + 120°)$$

Writing voltages e_1, e_2 and e_3 in the phasor form,

$$\overline{E}_1 = \frac{20}{\sqrt{2}} \angle 0° = 14.14 \angle 0°$$

$$\overline{E}_2 = \frac{30}{\sqrt{2}} \angle{-45°} = 21.21 \angle{-45°}$$

$$\overline{E}_3 = \frac{40}{\sqrt{2}} \angle 120° = 28.28 \angle 120°$$

Resultant voltage $\overline{E} = \overline{E}_1 + \overline{E}_2 + \overline{E}_3$

$$= 14.14 \angle 0° + 21.21 \angle{-45°} + 28.28 \angle 120° = 17.75 \angle 32.33°$$

$$e = 17.75\sqrt{2} \sin(\omega t + 32.33°) = 25.1 \sin(\omega t + 32.33°)$$