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Friday

Date: 26/08/2011

Series Resonance

The frequency at which the value of inductive (X_L) is equal to capacitive reactance (X_C) is known as resonance frequency and this condition is known as resonance.

$$X_L = X_C$$

$$\omega L = \frac{1}{\omega C}$$

$$\omega^2 = \frac{1}{LC}$$

$$\omega = \frac{1}{\sqrt{LC}}$$

$$2\pi f = \frac{1}{\sqrt{LC}}$$

$$f = \frac{1}{2\pi\sqrt{LC}}$$

①. Impedance \rightarrow

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

At $X_L = X_C$

$$Z_0 = \sqrt{R^2 + (X_C - X_C)^2}$$

August 11

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Tuesday	2	9	16	23	30
Wednesday	3	10	17	24	31
Thursday	4	11	18	25	
Friday	5	12	19	26	
Saturday	6	13	20	27	
Sunday	7	14	21	28	

Notes

$$Z_0 = \sqrt{R^2}$$

Approximation

$$Z_0 = R \quad (\text{minimum})$$

② Current :-

$$I = \frac{V}{Z}$$

$$I_0 = \frac{V}{Z_0} = \frac{V}{R}$$

$$I_0 = \frac{V}{R} \quad (\text{maximum})$$

③ Power factor :-

$$\cos \phi = \frac{R}{Z}$$

$$\cos \phi_0 = \frac{Z_0}{R} = \frac{R}{R}$$

$$\cos \phi_0 = 1$$

$$\phi_0 = \cos^{-1} 1 = 0^\circ$$

Sunday 28

④ Active Power :-

$$P = VI \cos \phi$$

$$P_0 = VI_0 \cos \phi_0$$

$$= \frac{V \cdot V}{R} \cos 0^\circ$$

$$P_0 = \frac{V^2}{R} \quad \text{watt}$$

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⑤ Reactive power :-

$$Q = VI \sin \phi \text{ (VAR)}$$

$$Q_0 = V I_0 \sin \phi_0$$

$$Q_0 = V I_0 \sin 0^\circ$$

$$Q_0 = 0 \text{ (VAR)}$$

⑥ Apparent power :-

$$S = V \cdot I$$

$$S_0 = V \cdot I_0$$

$$S_0 = V \cdot \frac{V}{R}$$

$$S_0 = \frac{V^2}{R} \text{ (VA)}$$

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Appointment

Q-factor of series Resonating Circuit • Week 36

In a series resonating circuit Q factor (quality factor) is defined as the ratio of voltage across inductor (V_L) or Capacitor (V_C) to the applied voltage.

$$Q = \frac{V_L}{V} = \frac{V_C}{V}$$

for inductor

$$Q = \frac{V_L}{V} = \frac{IX_L}{IR} \quad (\text{at resonance condition})$$

$$Q = \frac{X_L}{R} = \frac{\omega_0 L}{R}$$

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$$Q = \frac{1}{\sqrt{LC}} \times \frac{L}{R}$$

$$= \frac{1}{\sqrt{LC}} \times \frac{\sqrt{L} \cdot \sqrt{L}}{R}$$

$$Q = \frac{1}{R} \sqrt{\frac{L}{C}}$$

for Capacitor :-

$$Q = \frac{V_C}{V} = \frac{IX_C}{IR} \quad (\text{at resonance condition})$$

$$Q = \frac{X_C}{R}$$

$$Q = \frac{1}{\omega_0 CR}$$

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$$\text{Here } \omega_0 = \frac{1}{\sqrt{LC}}$$

$$Q = \frac{1}{\frac{1}{R} \times CR}$$

$$Q = \frac{L}{R} \sqrt{\frac{C}{L}}$$

quality factor for resonant circuit in inductor and capacitor are same.

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