

Unit I: Assessment: Q & A (Selected)**Lecture 25**

1. A choke coil is connected to a 240V AC supply. When the frequency of the supply is 50Hz, an ammeter connected in series with the choke reads 60A. On increasing the frequency of the supply to 100Hz, the same ammeter reads 40A. Calculate r and L of the coil.

Solution

Given:

- **Supply Voltage** (V) = 240 V (rms)
- **Current at 50 Hz** (I_1) = 60 A
- **Current at 100 Hz** (I_2) = 40 A

Let:

- r = resistance of the coil (Ω)
- L = inductance of the coil (H)

Step 1: Impedance at Each Frequency

The impedance of a choke coil is:

$$Z = \sqrt{r^2 + (2\pi fL)^2}$$

At 50 Hz:

$$Z_1 = \frac{V}{I_1} = \frac{240}{60} = 4 \Omega$$

At 100 Hz:

$$Z_2 = \frac{V}{I_2} = \frac{240}{40} = 6 \Omega$$

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Step 2: Form the Equations

For 50 Hz:

$$4 = \sqrt{r^2 + (2\pi \times 50 \times L)^2}$$

For 100 Hz:

$$6 = \sqrt{r^2 + (2\pi \times 100 \times L)^2}$$

Step 3: Solve for r and L

Squaring both sides:

$$1. \quad 16 = r^2 + (314.16L)^2$$

$$2. \quad 36 = r^2 + (628.32L)^2$$

Subtract (1) from (2):

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$$36 - 16 = (628.32^2 - 314.16^2)L^2$$

$$20 = (394784 - 98696)L^2$$

$$20 = 296088L^2$$

$$L^2 = \frac{20}{296088}$$

$$L \approx 0.00822 \text{ H}$$

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Now substitute L back into (1):

$$16 = r^2 + (314.16 \times 0.00822)^2$$

$$16 = r^2 + (2.582)^2$$

$$16 = r^2 + 6.667$$

$$r^2 = 16 - 6.667 = 9.333$$

$$r \approx 3.06 \, \Omega$$