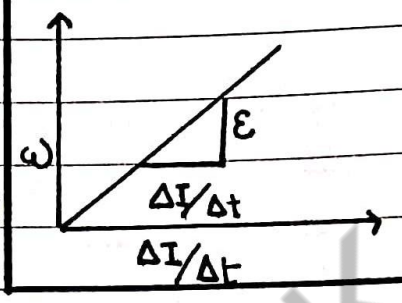
Q No 1 (Page 1/6) The graph is a straight line.

→ EXPLANATION:

Graph:



• Self induced emf: Self induced emf can be mathematically expressed as $\mathcal{E} = L\frac{\Delta I}{\Delta t}$ or $\mathcal{E} \propto \frac{\Delta I}{\Delta t}$

• Straight line: As induced emf varies directly with rate of change of current, graph is a straight line.

→ SIGNIFICANCE:

The slope between $\Delta I/\Delta t$ and $\mathcal{E}$ gives the value of **self inductance 'L'.**

Mathematically:

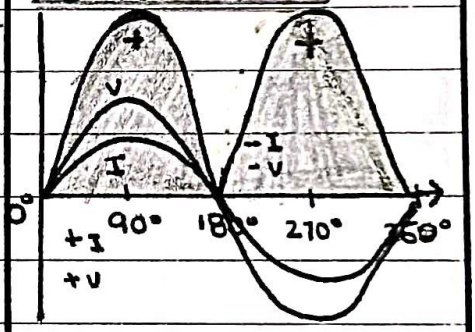
slope $= \mathcal{E}/\frac{\Delta I}{\Delta t}$ $\quad L = \mathcal{E}/\frac{\Delta I}{\Delta t}$

→ Thus we can calculate self inductance 'L' of coil through the slope

Q NO 2: → Changing polarity of AC:

Alternating current changes polarity resulting in negative and positive I and V values.

Power curve:



→ Power dissipated in Resistor:

Power loss in AC circuit through resistor is always positive because voltage and current are always inphase.

Mathematically: power factor $\cos 0° = 1$

$\langle P \rangle = V_{rms} I_{rms}$

• During positive half cycle 0→180°: V and I are positive

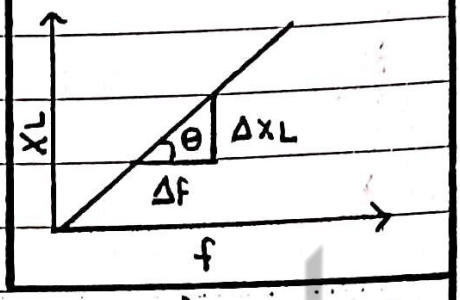
thus $\langle P \rangle = (+V_{rms})(-V_{rms})$

• During Negative half cycle 180°→360°: V and I are negative

thus $\langle P \rangle = (-V_{rms})(-V_{rms})$, $\langle P \rangle = V_{rms} I_{rms}$

Q NO 3 (Page 2/6) Gradient of a graph of inductive reactance against frequency helps us to measure self inductance of the inductor.

Graph:



→EXPLANATION:

- **Inductive reactance:** Inductive reactance can mathematically be expressed as $X_L = \omega L$ or $X_L \propto \omega$ or $\boxed{X_L \propto 2\pi f}$
- **Straight line:** X_L varies directly with f thus straight line is obtained
- **Gradient or slope:** $\boxed{\text{slope} = \Delta X_L / \Delta f}$ (i)

as $\Delta X_L = 2\pi (\Delta f) L$

$L = \frac{1}{2\pi} \times \frac{\Delta X_L}{\Delta f}$ from (i) we can say $\boxed{L = \frac{1}{2\pi} \times \text{slope of graph}}$

→CONCLUSION: With the help of this gradient, we can measure self inductance of inductor.

Q NO 4: →EFFECT OF DOUBLING FREQUENCY ON

(a) Inductive Reactance: Inductive reactance is given by $\boxed{X_L = 2\pi f L}$ (i) putting $f' = 2f$ $X_L' = 2\pi f' L$ or $X_L' = 2\pi (2f) L$

$X_L' = 2 (2\pi f L)$ from (i) we can deduce

$\boxed{X_L' = 2 X_L}$

→ **Result:** When frequency is doubled, X_L also becomes **double**

(b) Capacitive Reactance: Capacitive reactance is given by $\boxed{X_C = \frac{1}{2\pi f C}}$ (ii) and $X_C' = \frac{1}{2\pi f' C}$

putting $f' = 2f$

$X_C' = \frac{1}{2\pi (2f) C}$

or $X_C' = \frac{1}{2} \left(\frac{1}{2\pi f C}\right)$ comparing with (ii) we can deduce

$\boxed{X_C' = \frac{1}{2} X_C}$

→ **Result:** When frequency is doubled then capacitive reactance becomes **half.**

Q NO 5 (Page 5/6)

→ **GIVEN DATA:** Peak value of voltage $V_m = 1000$ volts

→ **REQUIRED:**

$V_{r.m.s} = ?$

→ **FORMULA:** $V_{r.m.s} = V_m/\sqrt{2}$ (i)

→ **CALCULATIONS:**

Putting values in formula (i) we get

$V_{r.m.s} = 0.707 \times 1000$ volts

$V_{r.m.s} = 707$ volts

→ **RESULT:**

The effective or RMS value of voltage is 707 volts.

Q NO 6:

→ **INDUCTIVE REACTANCE:**

"The opposition provided by the inductor in the flow of AC is called inductive Reactance."

Mathematically: $X_L = \omega L = 2\pi f L$

$X_L = 2\pi(\frac{1}{T})L$ unit for $L = Vs/A$ thus

$X_L = (1/s)(Vs/A) = V/A$ unit of X_L = ohm Ω $[V/A = \Omega]$

→ **CAPACITIVE REACTANCE:**

"The opposition offered by a capacitor to flow of AC is called capacitive reactance."

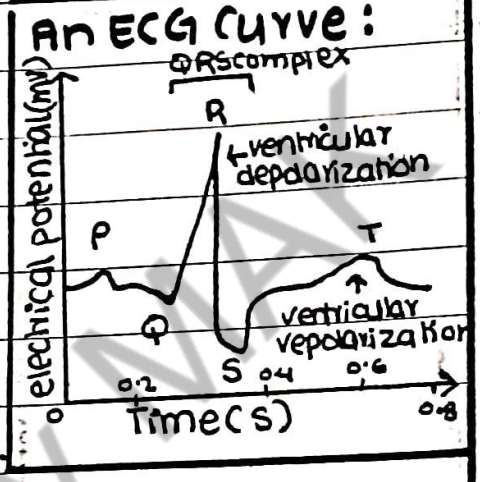
Mathematically: $X_C = 1/2\pi fC$

where $f = 1/T$ and C = Farad. Thus units of X_C

$X_C = 1/(1/s)F$ where Farad $= C/V$ $X_C = \frac{1}{(A/s)(s/V)} = \frac{V}{C/s}$ $[\frac{C}{s} = A]$

units of $X_C = \frac{V}{A}$ = ohm Ω $[V/A = \text{ohm}]$

Q NO2. (Lvii) → **ECG:** An ECG is simply a representation of the electrical activity of the heart muscle as it changes with time.



→ **PRINCIPLE OF ECG:**

- **Electrical Depolarization:** At every beat, cardiac muscles contracts in response to electrical depolarization of the muscle cells. This electrical activity can be picked up on the skin.
- **Deflection:** When the wave of depolarization travels towards a recording lead, it results in positive or upward deflection. A negative deflection indicates that recorded wave has travelled away from electrode.
- **Display:** An ECG machine records electrical activity via electrodes and displays it graphically.