Alternating Current

Instantaneous value of alternating current at any instant of time	$I = I_0 \sin \omega t$ I_0 = peak value of alternating current
Root Mean Square Value of Alternating Current	$I_{rms} = \sqrt{\frac{\int I^2 dt}{\int dt}}$ $I_{rms} = \frac{I_0}{\sqrt{2}}$ $V_{rms} = \frac{V_0}{\sqrt{2}}$
Impedance The opposition offered by an AC circuit containing more than one out of three components L,C and R is called impedanc (Z) of the circuit.	Impedance of an AC circuit, $Z = \sqrt{R^2 + (\chi_L - \chi_C)^2}$
Power of an AC Circuit	$P_{av} = V_{rms} I_{rms} \cos \theta$ Where $\cos\theta = \frac{Resistance}{Impedence}$

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A/C	Sinusodial A/C	Square A/C	Triangular
$(Avg)_{full}$	0	0	0
$(Avg)_{half}$	$\frac{2I_0}{\pi}$	I_0	$\frac{I_0}{2}$
r.m.s.	$\frac{I_0}{\sqrt{2}}$	I_0	$\frac{I_0}{\sqrt{3}}$

Circuit	Phase Difference between I and V	Power Factor $\cos\phi = \frac{R}{Z}$	Impedence	Who Leads	Power Loss
Pure Resistive	Zero	1	R	Same Phase	$P = I_{rms} = V_{rms}$
Pure Capacitive	$\frac{\pi}{2}$	Zero	$\chi_C = \frac{1}{\omega C}$	Current	Zero
Pure Inductive	$\frac{\pi}{2}$	Zero	$\chi_L = \omega L$	Voltage	Zero
R-L	$0<\phi<\pi/2$	Between 0 and 1	$\sqrt{R^2+\chi_L^2}$	Voltage	$P = I_{rms} = V_{rms}\frac{R}{Z}$
R-C	$0<\phi<\pi/2$	Between 0 and 1	$\sqrt{R^2+\chi_C^2}$	Current	
L-C	$\pi/2$	Zero	$\chi_L-\chi_C$	Depends	

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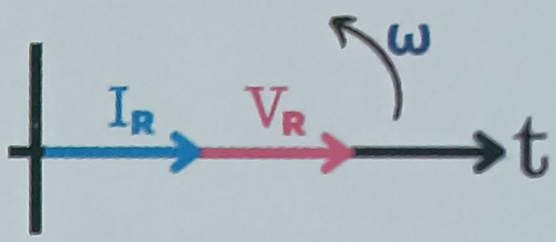
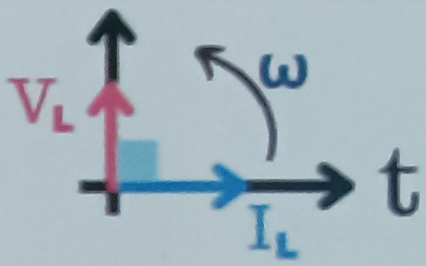
Phasor Diagrams for differenet AC Circuits

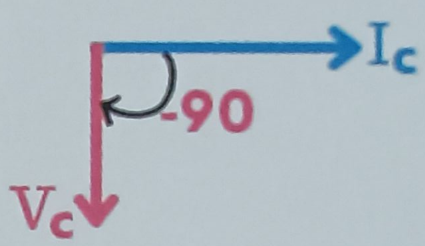
Pure Resistive



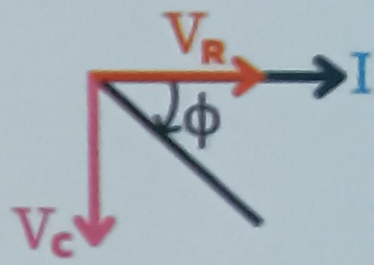
Pure Inductive



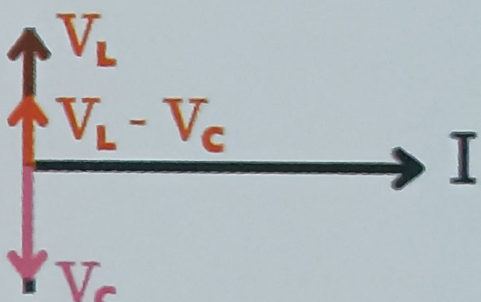
Pure Capacitive



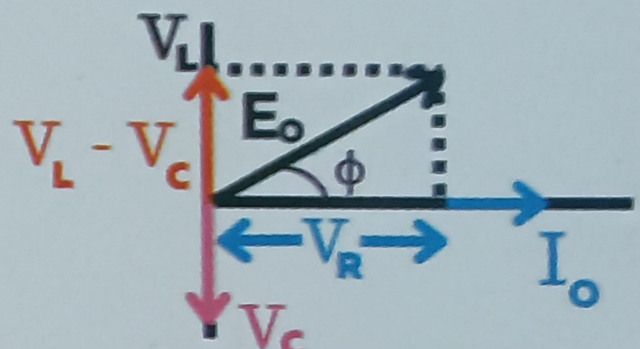
R-C



L-C



L-C-R



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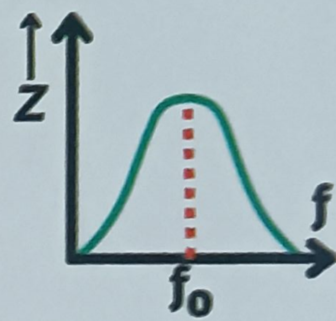
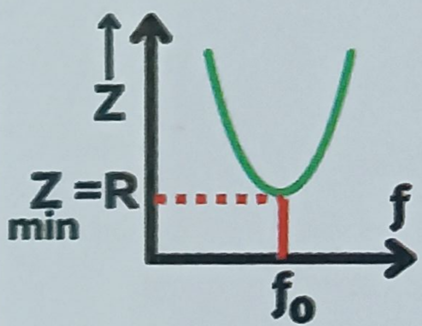
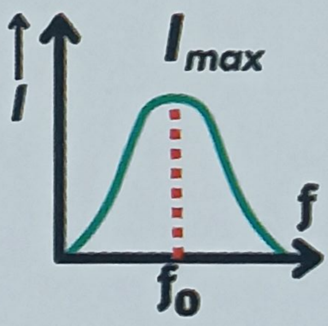
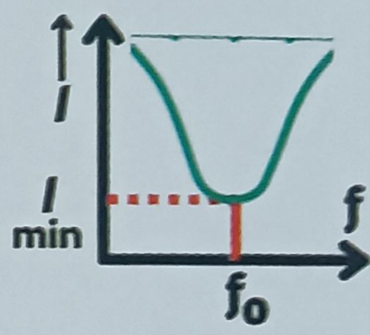
Resonance in AC Circuit

The condition in which current is maximum or impedance is minimum or vice-versa in an AC circuit is called resonance.

Series Resonance Circuit	Parallel Resonance Circuit
At resonance, $\chi_L = \chi_C$ Resonance frequency, $f = \frac{1}{2\pi\sqrt{LC}}$ Q factor or sharpness at resonance, $Q = \frac{1}{R}\sqrt{\frac{L}{C}}$	At resonance, $\chi_L = \chi_C$ 
 	

LC Oscillation → Energy Conserved	$(U_C + U_L)_{initial} = (U_C + U_L)_{final}$

Transformer

Ratio of Secondary and Primary Voltage where N_P and N_S are number of turns in primary and secondary coil respectively	$\frac{V_S}{V_P} = \frac{N_S}{N_P}$
Ratio of Secondary and Primary Current	$\frac{I_S}{I_P} = \frac{N_P}{N_S}$

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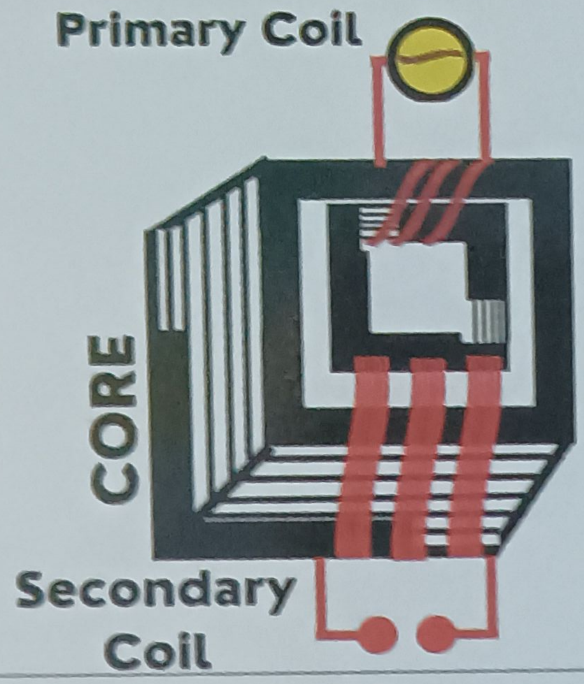
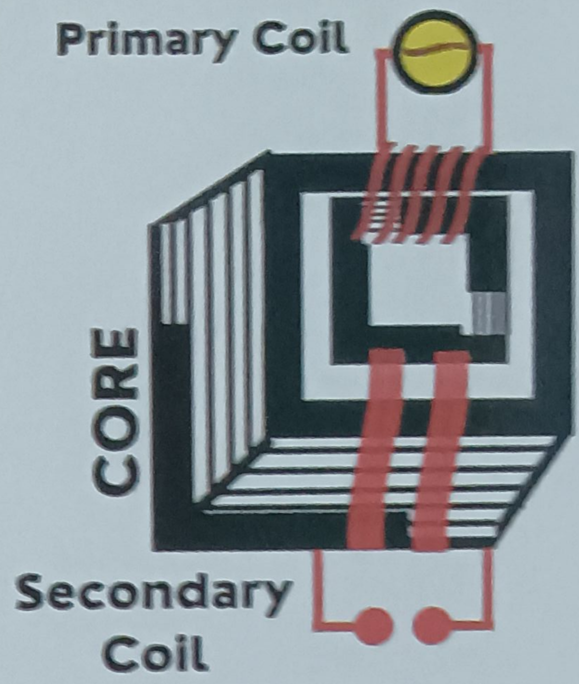
Step up Transformer	Step down Transformer
	
$V_{output} > V_{input}$ $N_S > N_P$ $I_S < I_P$ $P_{input} = P_{output}$	$V_{output} < V_{input}$ $N_S < N_P$ $I_S > I_P$ $P_{input} = P_{output}$

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NEET 2023 PYQ'S (Chapter 17-18)

- In a series LCR circuit, the inductance L is 10 mH, capacitance C is 1 μF and resistance R is 100 Ω. The frequency at which resonance occurs is : **1.59 kHz**

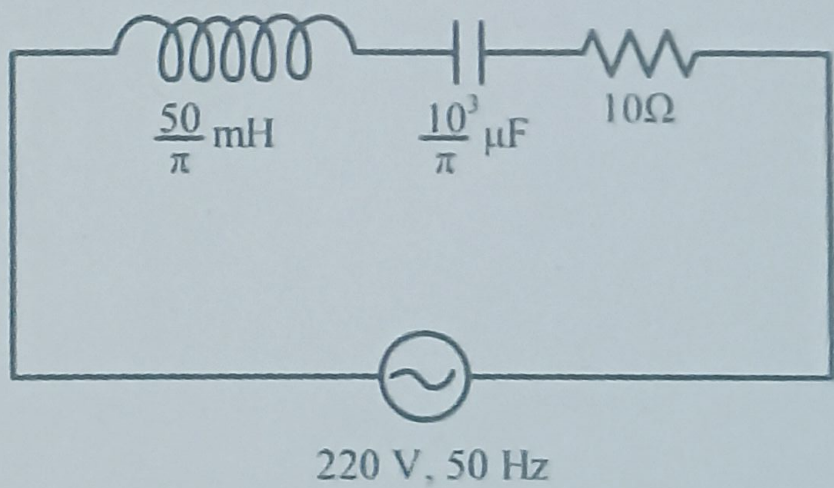
- The net magnetic flux through any closed surface is : **Zero**

- A 12 V,60 W lamp is connected to the secondary of a step down transformer, whose primary is connected to ac mains of 220 V. Assuming the transformer to be ideal, what is the current in the primary winding : **0.27A**

- An ac source is connected to a capacitor C. Due to decrease in its operating frequency : **Displacement Current Decreases**

- The magnetic energy stored in an inductor of inductance 4 μH carrying a current of 2 A is : **8 μJ**

- The net impedance of circuit (as shown in figure) will be : **$5\sqrt{5}\Omega$**



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