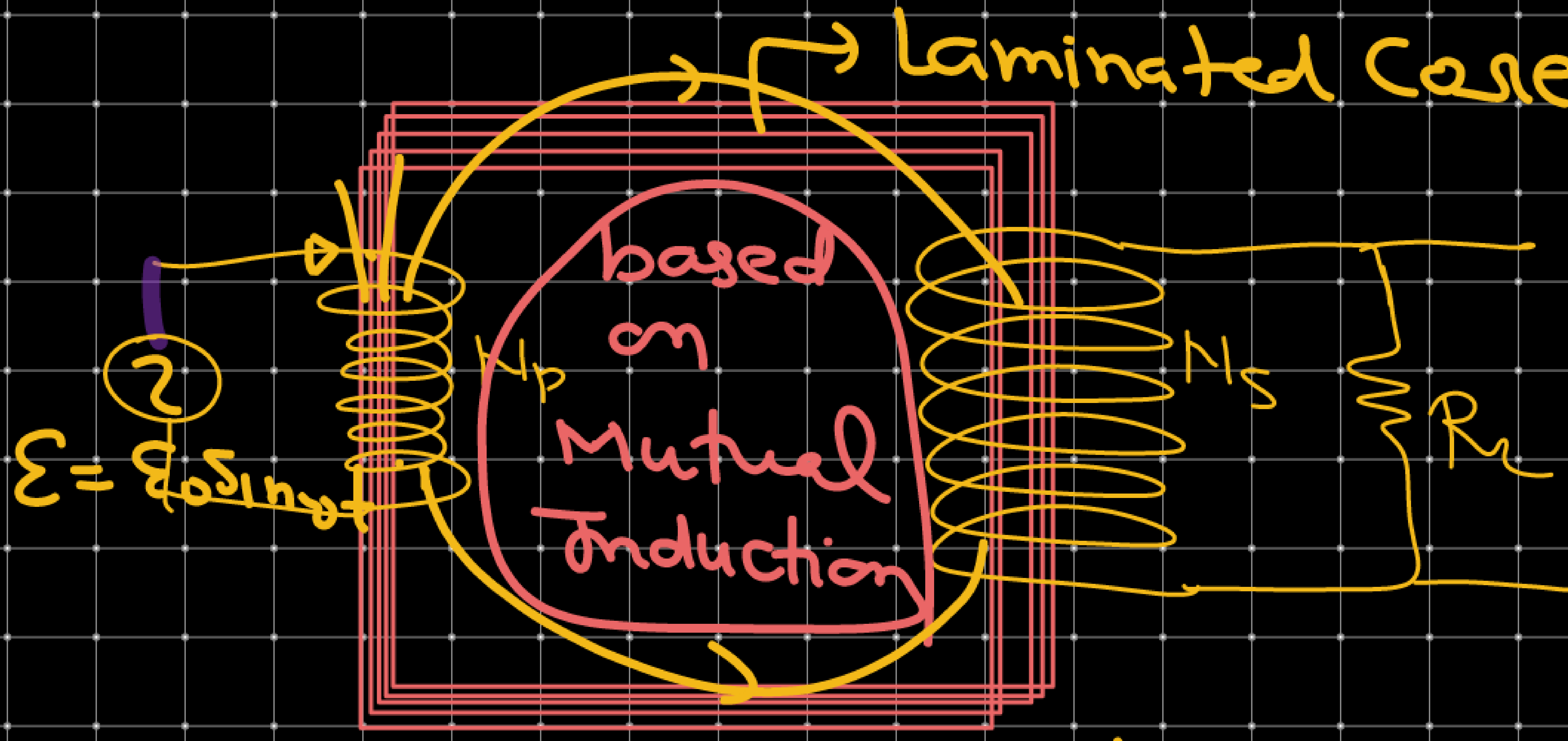


based on Mutual Induction

$$\boxed{\frac{\varepsilon_p}{\varepsilon_s} = \frac{N_p}{N_s}}$$

$N_s > N_p$

↳ Step up

$$\varepsilon_p = -N_p\left(\frac{d\phi}{dt}\right)$$

$$\varepsilon_s = -N_s\left(\frac{d\phi}{dt}\right)$$

$\Rightarrow N_s < N_p$

↳ Step Down voltage

Always valid

$$\boxed{\frac{\varepsilon_p}{\varepsilon_s} = \frac{N_p}{N_s}}$$

$N_p < N_s$	$N_p > N_s$
→ Step up	Step down.

⇒ Power input

Input power = $\varepsilon_p i_p$

Output power = $\varepsilon_s i_s$

$\Rightarrow \boxed{\frac{\varepsilon_p}{\varepsilon_s} = \frac{N_p}{N_s}} \Rightarrow$ Always valid.

$\Rightarrow$ Input power $= \varepsilon_p i_p$

Output power $= \varepsilon_s i_s$

If 100% efficiency

$\Downarrow$

Input Power = output Power

$\varepsilon_p i_p = \varepsilon_s i_s$

$$\boxed{\boxed{\frac{\varepsilon_p}{\varepsilon_s} = \frac{i_s}{i_p} = \frac{N_p}{N_s}}}$$

$\rightarrow$ 6 Question

AIPMT 2007) The primary & secondary coil of a transformer have 50 & 1500 turns respectively magnetic flux linked with primary coil given by $\phi = (\phi_0 + 4t)$, wb. the output voltage across secondary coil.

(a) 30V

(b) 90V

[✓ (c)] 120V

(d) 220V

Solve) $N_p = 50$ $\quad N_s = 1500$

$$\phi_p = \phi_0 + 4t$$

$$\varepsilon_p = \frac{d\phi}{dt} = \frac{d}{dt}(\phi_0 + 4t)$$

$$= 4 \text{ Volt}$$

$$\varepsilon_p = 4 \text{ Volt}$$

$$\frac{\varepsilon_p}{\varepsilon_s} = \frac{N_p}{N_s}$$

$$\frac{4}{\varepsilon_s} = \frac{\cancel{50}}{\underset{30}{\cancel{1500}}}$$

$$\varepsilon_s = 120 \text{ Volt}$$

$\Rightarrow$ $\boxed{\underline{\underline{\eta\%}}\ \text{efficiency} = \frac{P_{out}}{P_{input}} \times 100}$

$P_{output} = \varepsilon_s i_s$

$P_{input} = \varepsilon_p i_p$

$$\boxed{\eta\% = \frac{\varepsilon_s i_s}{\varepsilon_p i_p} \times 100}$$

Q2) Efficiency of a transformer is 90%

In Primary coil 200V, 3KW is apply & secondary Current is 6 amp. then find Prim current & secondary Voltage.

Sol) $E_p = V_p = 200V$

$P_p = 3\times10^3 W = 3000W$

$I_s = \underline{6}\,amp$

$P = E_p\, i_p$

$30\cancel{00} = 2\cancel{00}\, i_p$

$i_p = 15\, amp$

$$\boxed{\eta\% = \frac{P_{out\,Put}}{P_{input}}\times 100}$$

$$\eta\% = \frac{V_s I_s}{V_p i_p}\times 100 \Rightarrow 90 = \frac{V_s \times \cancel{6}}{\cancel{3000}_{5\cancel{00}}}\times 1\cancel{00}$$

$$\boxed{V_s = 450\, Volt}$$

⇒ <u>Transformer :</u> Only work with AC.

↳ based on Mutual Induction

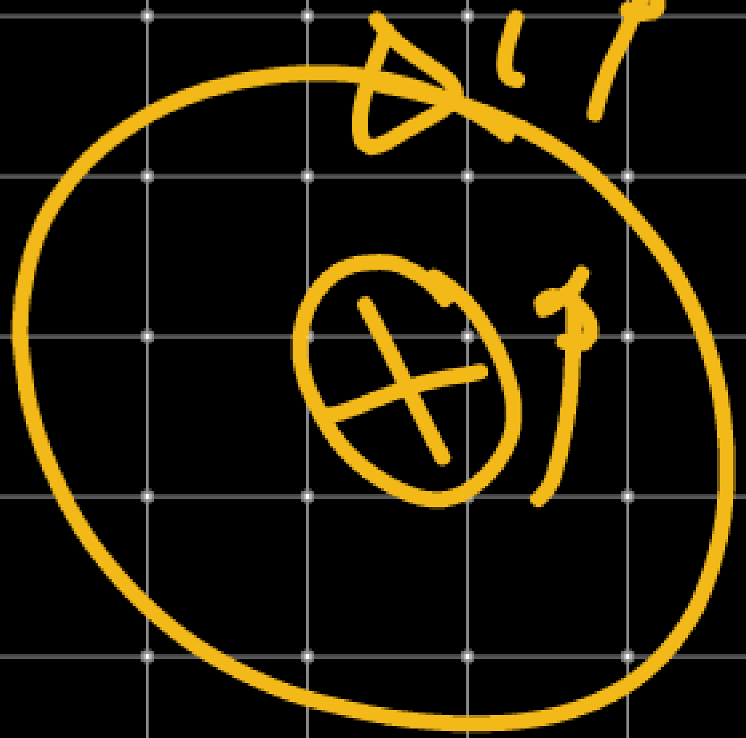
↳ Use for increase or decrease voltage,

↳ Use laminated core to reduce eddy current

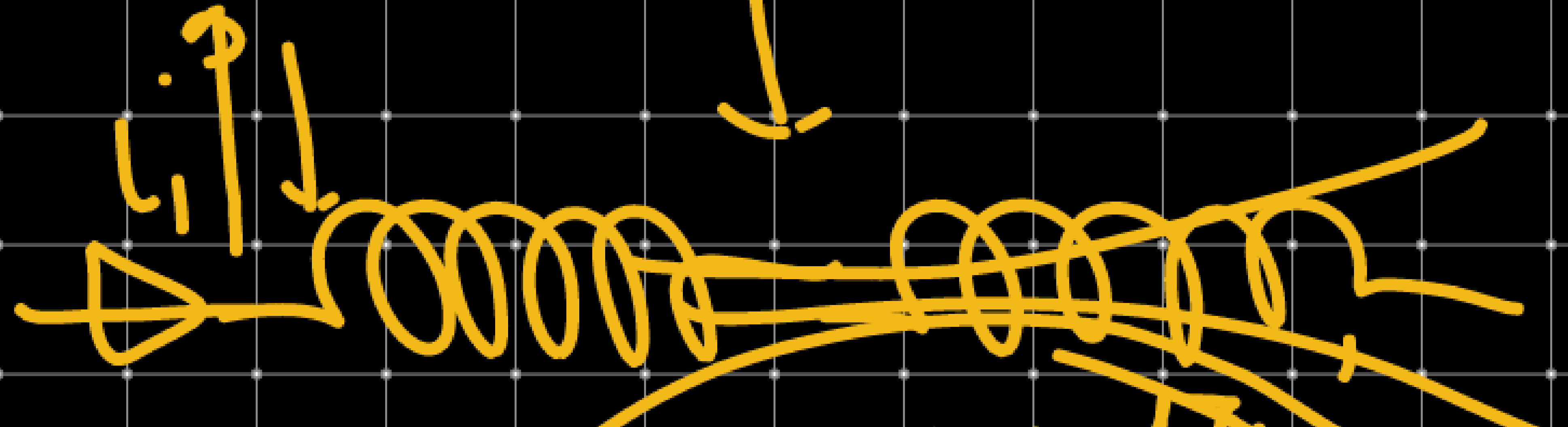
Static Induction

B → change

Self Induction



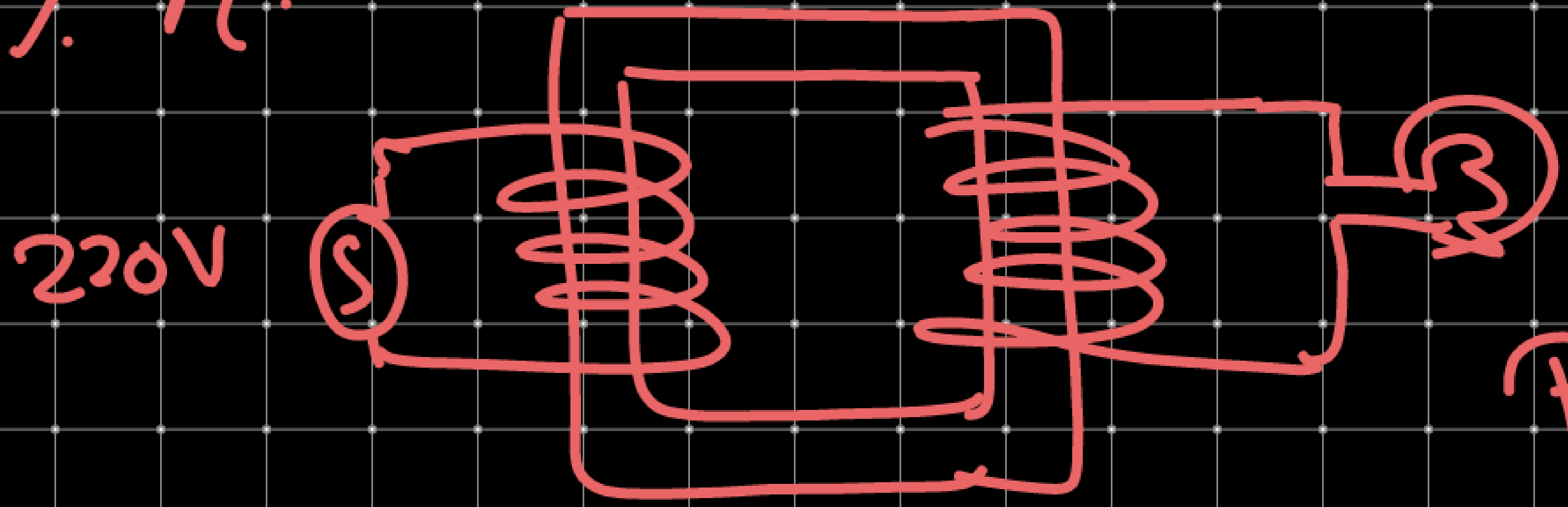
$B \uparrow$ $\phi \uparrow$



$$\varepsilon = -M \frac{di}{dt}$$

2014 Q) A transformer having efficiency of 90% is working on 200V & 3KW. If the current in the secondary coil is 6A. find Voltage across

Q) A bulb (100W, 110V) is operated using a transformer 220V, 0.5 amp. Then find %η.



100W, 110 Volt.

$P_{output} = 100W$

$P_{input} = V_p I_p$

$= 220 \times 0.5$

$= 110$ Volt-Amp

$= 110$ Watt

$\eta\% = \frac{100}{11\cancel{0}} \times 10\cancel{0}$

$= \frac{1000}{11}\%$

Q) A transformer is used to light a 100W & 110Volt lamp from a 220V main. If the main current is 0.5 Amp, Find η%. Approx.

(a) 10%.

(b) 30%.

(c) 50%.

[✓ (d) 90%.]

$$\boxed{P_S = 100W}$$

$V_S = 110\,\text{Volt}$

$V_p = 220\,\text{Volt}$

$i_p = 0.5\,\text{Amp}$

$$\boxed{\frac{N_p}{N_S} = \frac{E_p}{E_S}}$$

$$\eta\% = \frac{V_S i_S}{V_p i_p} \times 100$$

If 100%

$$\frac{E_p}{E_S} = \frac{N_p}{N_S} = \frac{i_p}{i_S}$$

$$\Rightarrow \eta\% = \frac{100}{220 \times 0.5} \times 100 \simeq 90\%$$

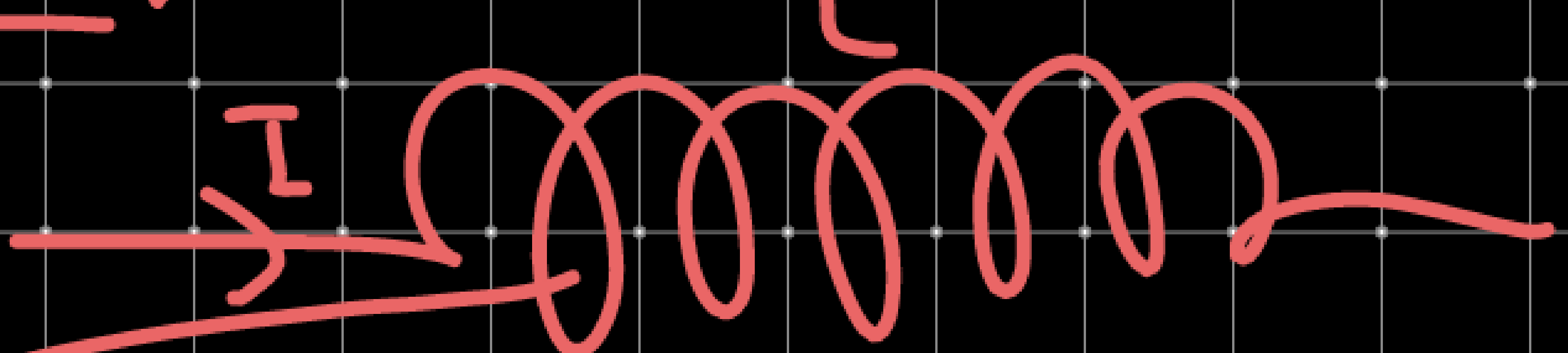
$E = \frac{1}{4\pi\varepsilon_0}$ $B = \frac{\mu_0}{4\pi}$

Energy store in Capacitor.

$$u = \frac{1}{2}\varepsilon_0 E^2$$

$$U = \frac{1}{2}CV^2 = \frac{Q^2}{2C} = \frac{1}{2}QV$$

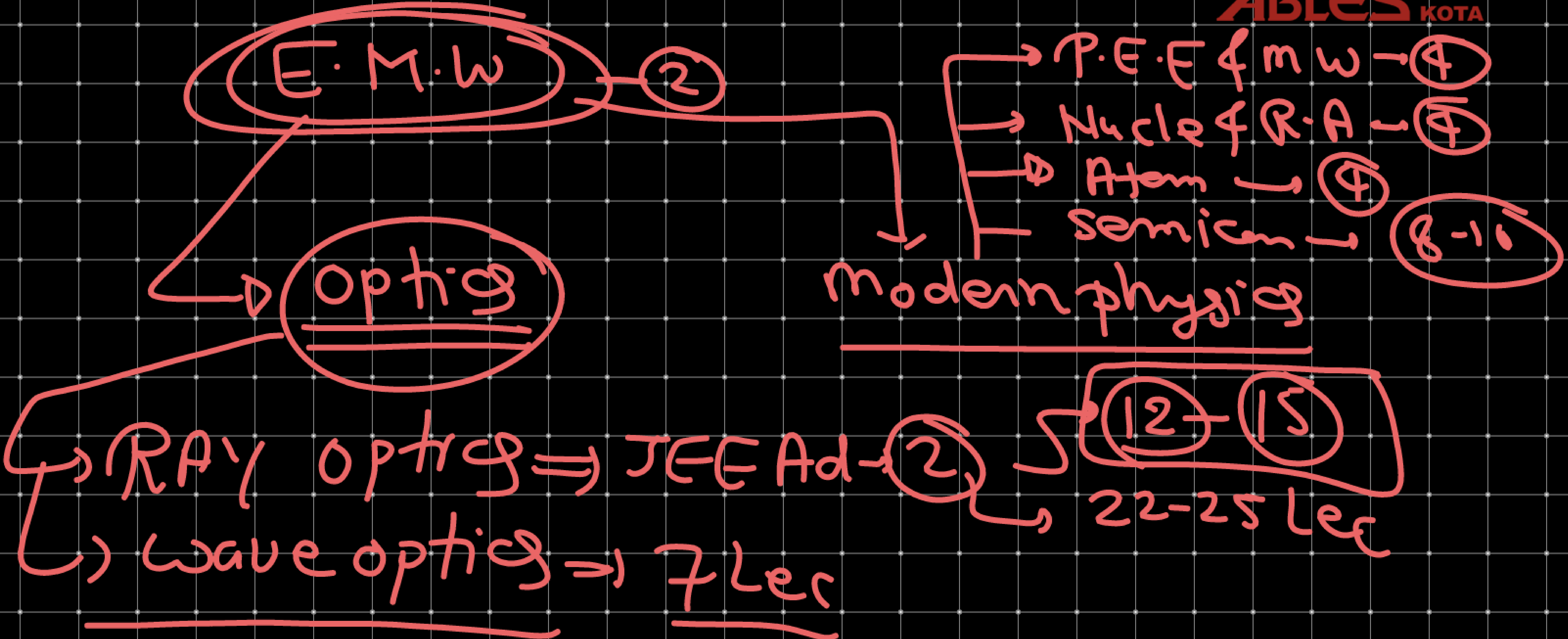
Energy store in form of Electric field or charge.



$$U = \frac{1}{2}LI^2$$

In form of magnetic field.

$$\boxed{u = \frac{1}{2\mu_0}B^2}$$



E.M.W → ②

Optics

→ RAY optics ⇒ JEE Ad → ② → ⑫ – ⑮

→ 22-25 Lec

→ wave optics ⇒ 7 Lec

→ P.E.E & mw → ④

→ Nucle & R.A → ④

→ Atom → ④

— semicon → (8-10)

modern physics