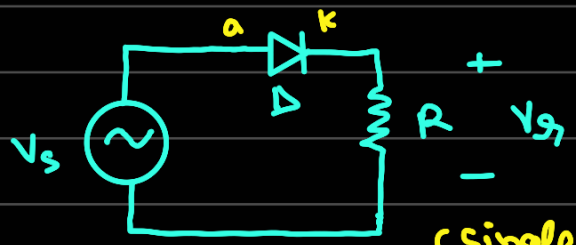
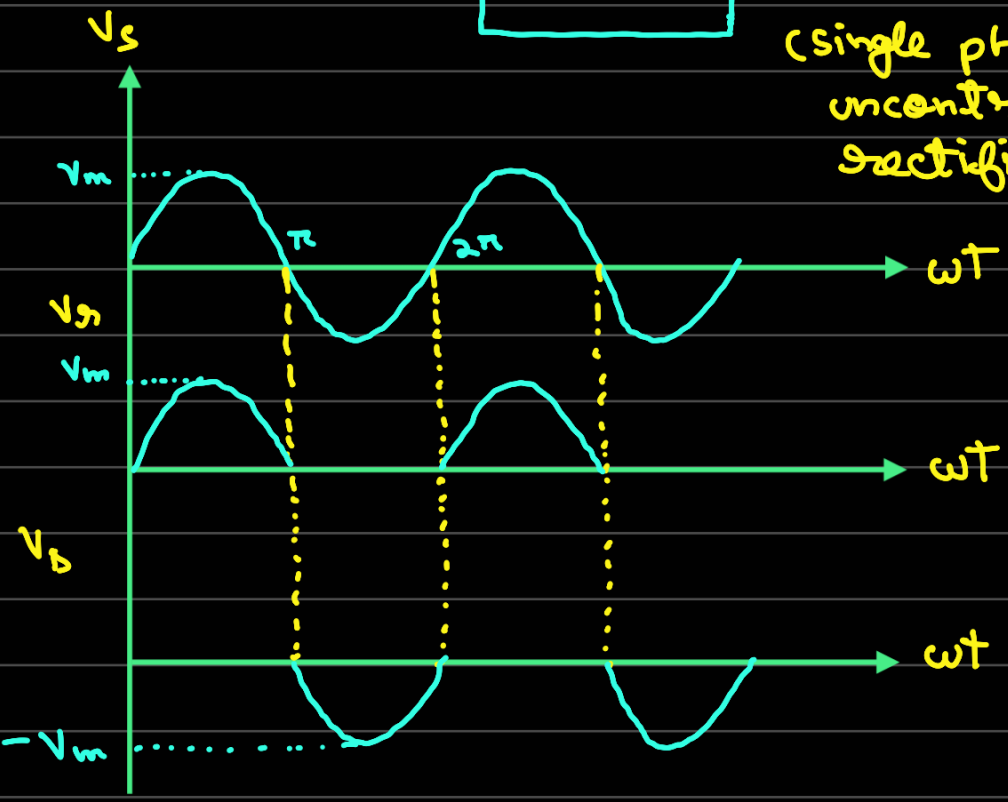
Day-3

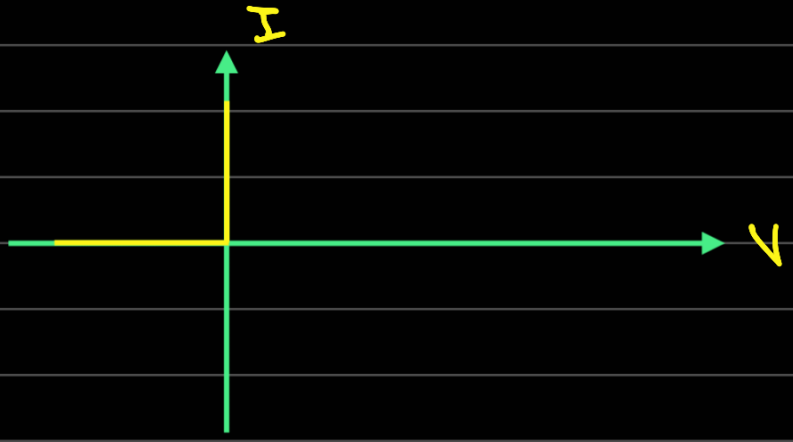
→ Revisiting Diode -





(single phase uncontrolled rectifier : 1ϕUCR)

→ Ideal diode characteristics :-



→ Find $\langle V_R \rangle$ if $V_s = V_m \sin \omega t$

Ans) $$\langle V_R \rangle = \frac{\omega}{2\pi} \int_0^{\pi/\omega} V_m \sin \omega t \, dt$$

$$= \frac{1}{2\pi} \int_0^{\pi} V_m \sin\theta \, d\theta \qquad (\theta = \omega t)$$

$$= \frac{V_m}{\pi}$$

$$\rightarrow \quad V_R(\text{rms}) = \sqrt{\frac{\omega}{2\pi} \int_0^{\pi/\omega} V_m^2 \sin^2 \omega t \, dt}$$

$$= \sqrt{\frac{V_m^2}{2\pi} \int_0^{\pi} \sin^2\theta \, d\theta}$$

$$= V_m \sqrt{\frac{1}{2\pi} \times \frac{\pi}{2}}$$

$$= \frac{V_m}{2}$$

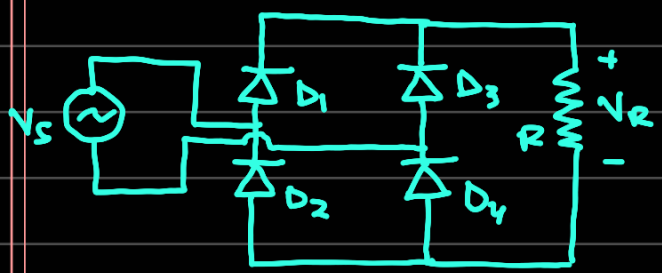
$\rightarrow$ Form factor, $F_{FF} = \dfrac{F_{rms}}{F_{avg}}$ $\left(\text{Here} = \dfrac{\pi}{2}\right)$

$\rightarrow$ Ripple factor,

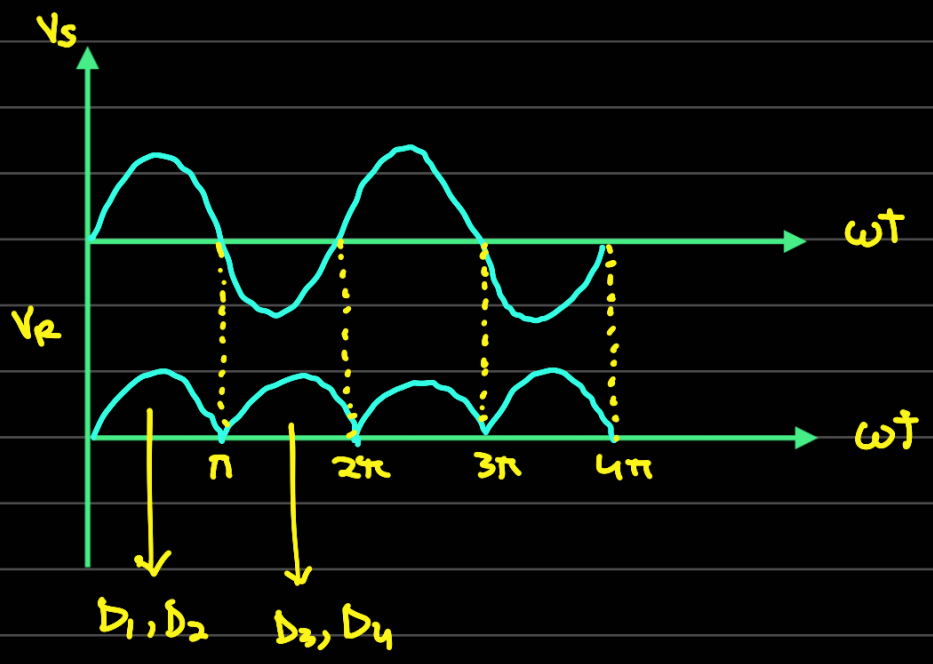
$$F_{ripple} = \frac{\sqrt{F_{rms}^2 - F_{avg}^2}}{F_{avg}} = \sqrt{F_{FF}^2 - 1}$$

$$\left(= \sqrt{(\pi/2)^2 - 1} \approx 1.21\right)$$

$\rightarrow$



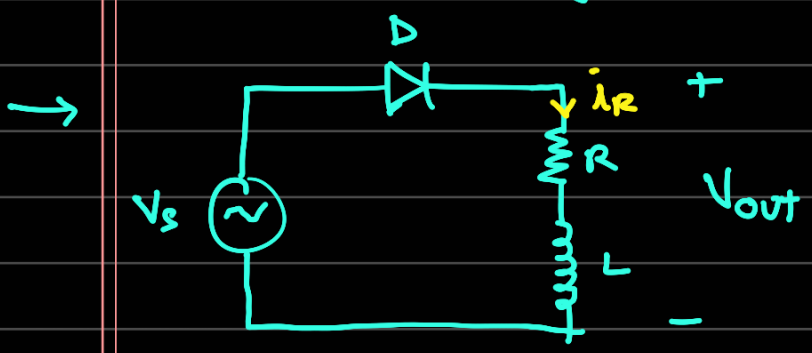
Single-phase diode-bridge rectifier (full-wave rectifier)



(i_R looks same as V_R with different amplitude)

$$\langle V_R \rangle = \frac{2V_m}{\pi}$$

$$\sqrt{\langle V_R^2 \rangle} = \frac{V_m}{\sqrt{2}}$$



$$i_R = \frac{V_{out}}{\sqrt{R^2+(\omega L)^2}} \sin(\omega t + \phi)$$

$$\phi = \tan^{-1}\frac{\omega L}{R}$$

$$V_L = L\frac{di}{dt}$$

$$\Rightarrow \frac{V_L}{L} = \frac{di}{dt}$$