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$$V_{avg.} = \frac{1}{\pi}\int_0^{\pi} v_o \, d\omega t = \frac{1}{\pi}\int_0^{\pi} V_m \sin(\omega t) \, d\omega t$$

$$= \frac{1}{\pi} \cdot V_m \; -\left(\cos\omega t\right)_0^{\pi}$$

$$= \frac{V_m}{\pi}(-1-1)(-1) = \boxed{\frac{2V_m}{\pi} = V_{avg.}}$$

$$V_{rms} = \left[\frac{1}{\pi}\int_0^{\pi} V_o^2 \, d\omega t\right]^{1/2}$$

$$= \left[\frac{1}{\pi}\int_0^{\pi} (V_m)^2 \sin^2\omega t \, d\omega t\right]^{1/2}$$

$$= \left[\frac{(V_m)^2}{\pi}\int_0^{\pi} \left(\frac{1-\cos 2\omega t}{2}\right) d\omega t\right]^{1/2}$$

$$= \left\{\left[\frac{(V_m)^2}{2\pi}\right]\left[(\pi) - \left[\frac{\sin 2\omega t}{2}\right]_0^{\pi}\right]\right\}^{1/2}$$

$$= \left(\frac{(V_m)^2 \cdot \pi}{2\pi}\right)^{1/2} = \frac{V_m}{\sqrt{2}}$$

$$\boxed{V_{rms} = \frac{V_m}{\sqrt{2}}}$$

Form factor

$$F.F. = \frac{V_{rms}}{V_{avg}} = \frac{V_m}{\sqrt{2}} \frac{\pi}{(2V_m)} = \frac{\pi}{2\sqrt{2}} = 1.11$$

Ripple factor

$$\gamma = \sqrt{(F.F)^2 - 1} = \sqrt{1.2321 - 1} = \sqrt{0.2321}$$

$$\gamma = 0.48$$

$$\boxed{\gamma \% = 48}$$

$$\text{Efficiency } (\% \eta) = \frac{\text{output power (dc)}}{\text{input power (ac)}} \times 100$$

$\rightarrow I_{rms}$.

For Full-wave

$$= \frac{(I_{dc})^2 R_L \times 100}{(I_{rms})^2 R_L} = \frac{(I_{dc})^2 \times 100}{(I_{rms})^2} = \left(\frac{V_{dc}}{V_{rms}}\right)^2 \times 100$$

$$= \left(\frac{2V_m}{\pi}\right)^2 \left(\frac{\sqrt{2}}{V_m}\right)^2 \times 100 = \frac{4 \times 2}{\pi^2} \times 100 = 81.13$$

For Half-wave :

$$\eta = \left(\frac{I_m}{\pi}\right)^2 \left(\frac{2}{I_m}\right)^2 \times 100 = \frac{4 \times 100}{\pi^2} = 40.56$$

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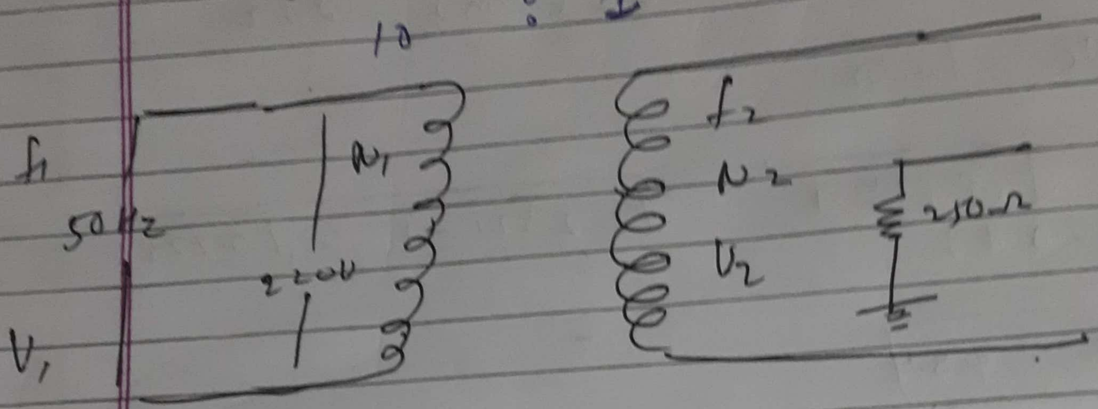
Ques For the given circuit find out the dc output voltage, rectification efficiency, peak inverse voltage, output frequency



$$\frac{N_1}{N_2} = \frac{10}{1} = \frac{V_1}{V_2} \Rightarrow V_2 = \frac{V_1}{10} = \frac{220}{10} = 22\,V$$

$$V_{rms} = \frac{V_m}{\sqrt{2}} \Rightarrow \boxed{V_m = 22\sqrt{2}\,V}$$

$$V_i = V_m \sin(2\pi f t)$$

$$V_i = 22\sqrt{2} \sin(50t)$$

$$V_{dc} = \frac{2V_m}{\pi} = \frac{2 \times 22\sqrt{2}}{\pi} = \frac{44\sqrt{2}}{\pi}\,V$$

$\eta = 48\%$

$$\eta = \frac{44\sqrt{2}}{\pi\, 22} \times 100$$

$\eta =$ ~~6...~~.

$$T_r = 2T_1$$

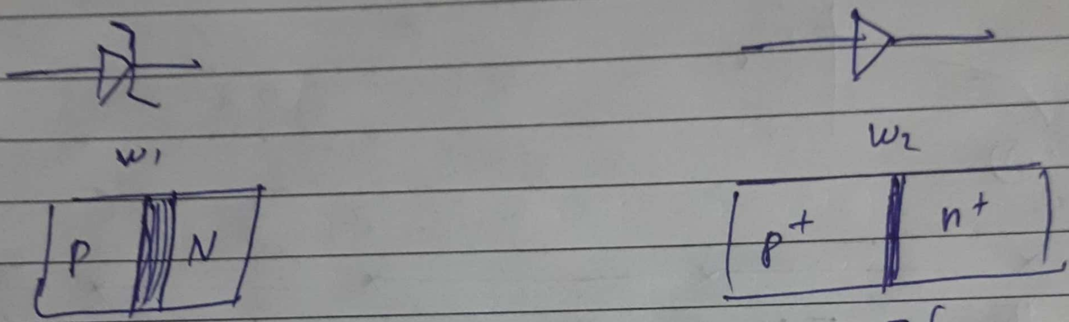
$$\frac{1}{f_1} = \frac{2}{f_2} \Rightarrow f_2 = 2f_1 = 100\,Hz$$

For peak inverse voltage.

$V_m = V_{inverse} = V_m \Rightarrow$ for bridge.

$V_{inverse} = 2V_m \Rightarrow$ Centre Tap

Avalanche & Zener Diode.

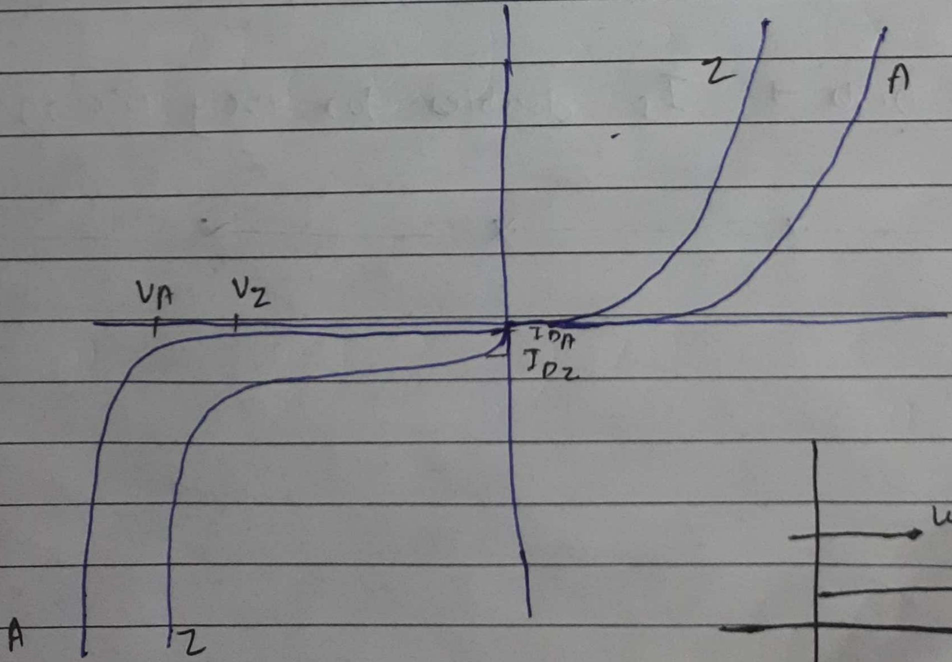


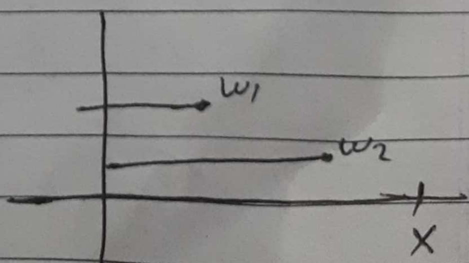
I_{f_1} $\quad$ I_{f_2}

For forward: $w_1 > w_2$

$I_{f_2} > I_{f_1}$

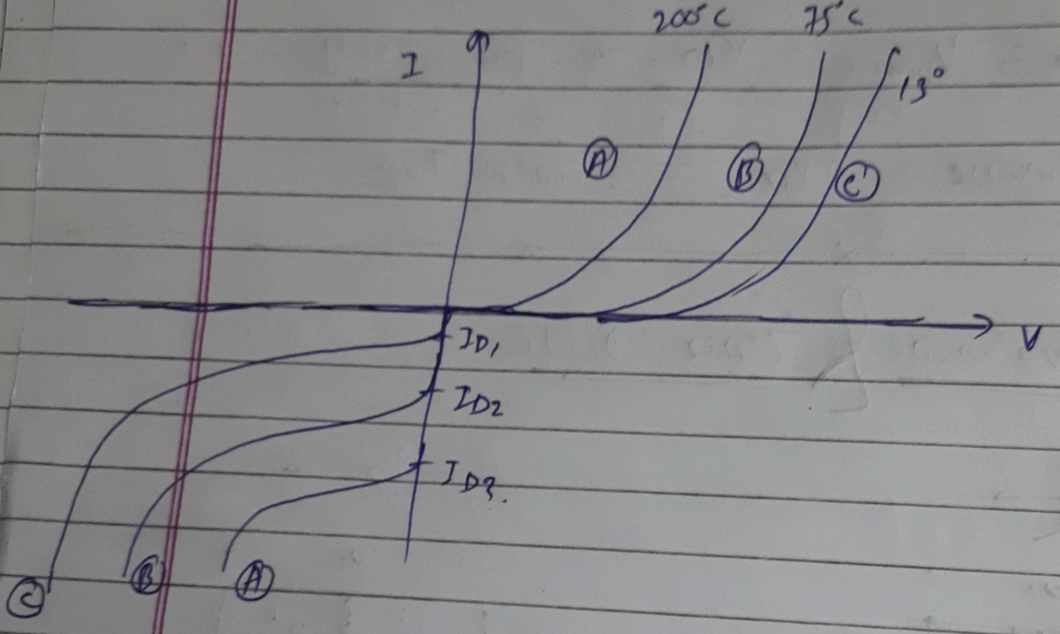
for Reverse: $w_2 > w_1$





Zener reaches breakdown first.

Effects of temp on V-I characteristics



Effect of Temperature on V-I characteristics

a) Forward bias → for Si diode, it shifts to left at rate of 2.5mV per degree rise in temp.

b) Reverse bias → I_s doubles for every 10°C rise in temp.