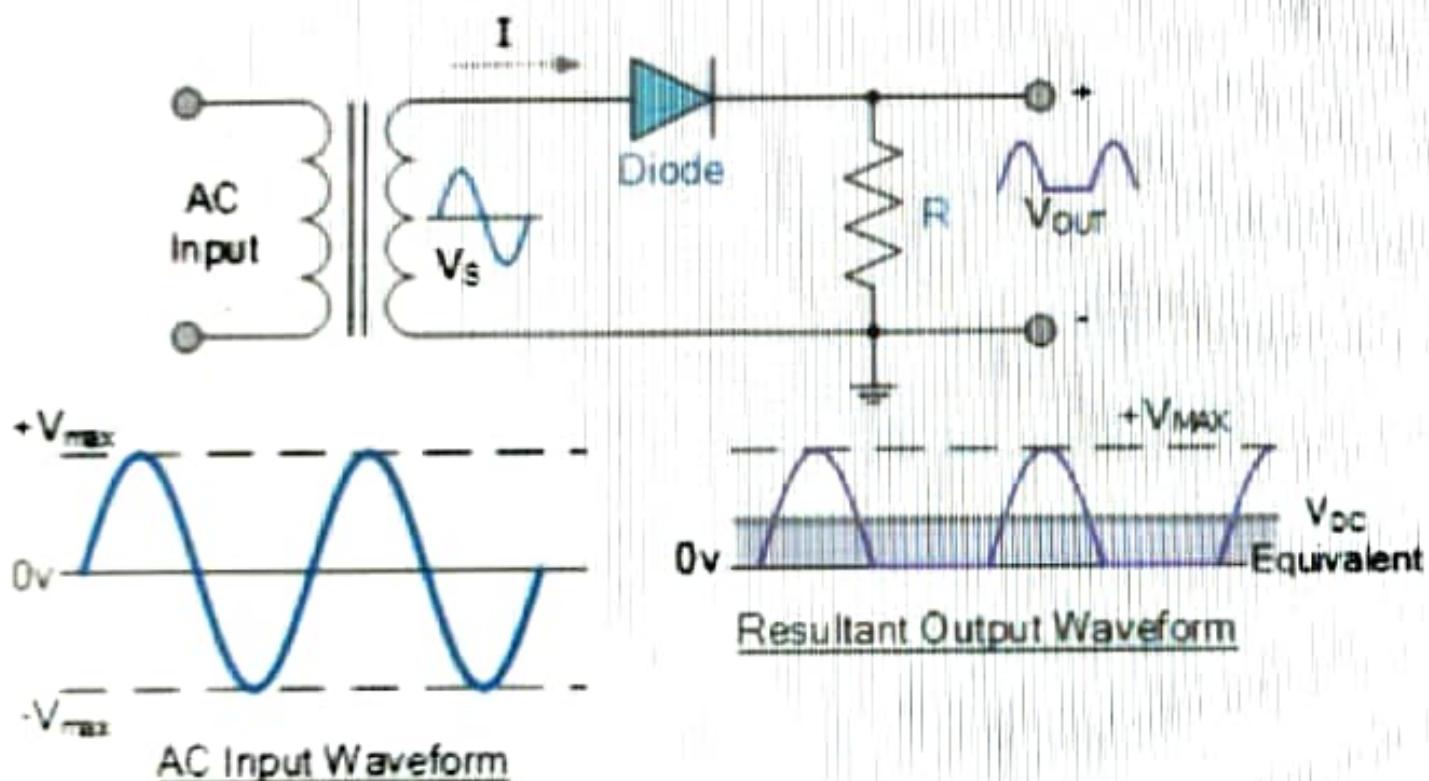
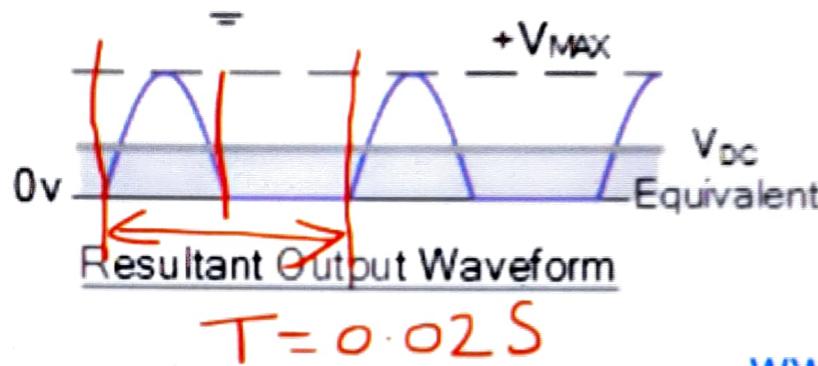
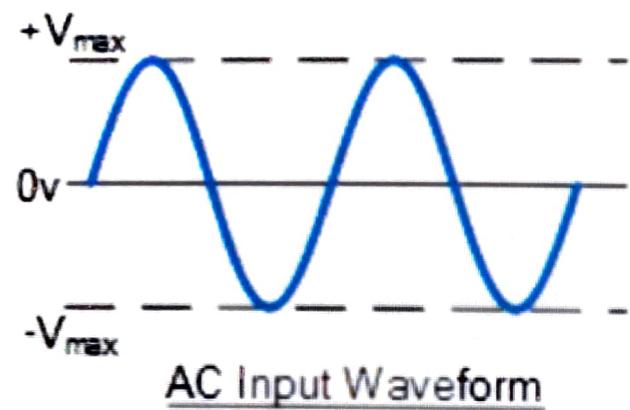


half-wave rectifier



half-wave rectifier



$$f = 50 \text{ Hz}$$

$$T = \frac{1}{f} = 0.02 \text{ S}$$

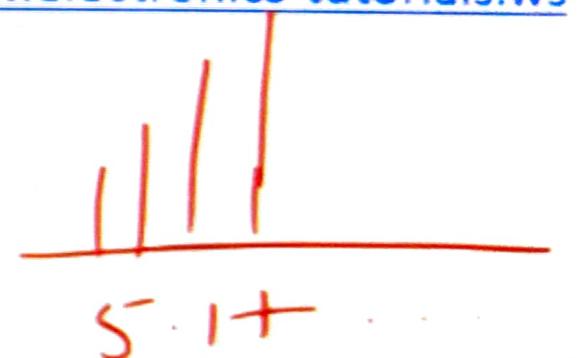
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$$V_{dc} = \frac{1}{2\pi} \left[\int_0^{\pi} v d\theta \right] = \frac{1}{2\pi} \left[\int_0^{\pi} (V_m \sin \theta) d\theta \right]$$

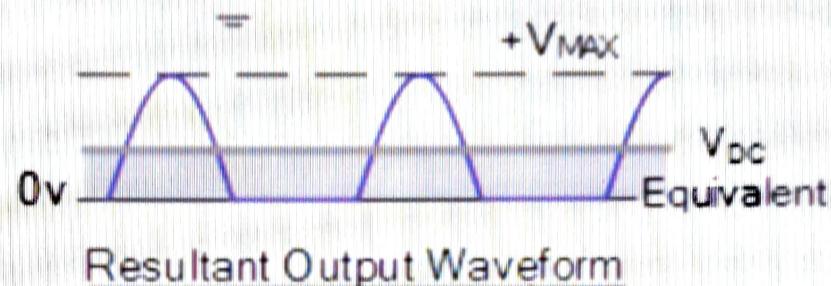
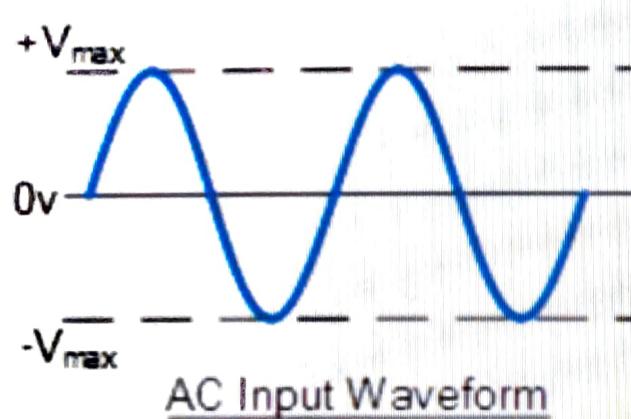
$$V_{dc} = \frac{V_m}{\pi}$$

$$V_{avg} = \frac{1}{T} \int_0^T v d\theta$$

average \rightarrow Integration +
slope \rightarrow diff = —



half-wave rectifier



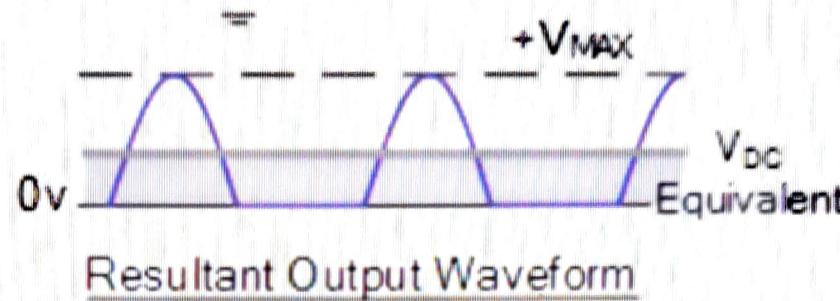
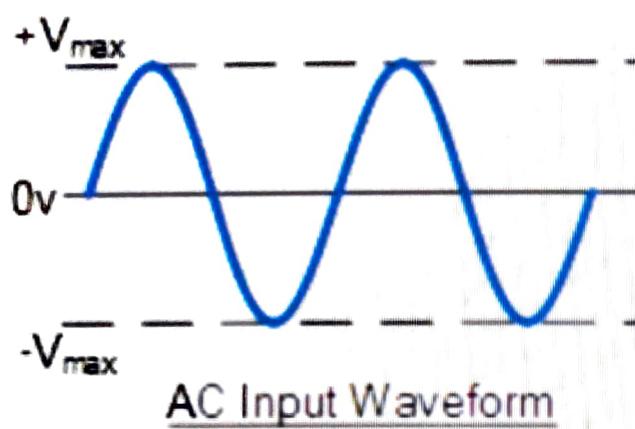
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$$\textcircled{V_{rms}} = \sqrt{\frac{1}{2\pi} \left[\int_0^{\pi} v^2 d\theta \right]} = \sqrt{\frac{1}{2\pi} \left[\int_0^{\pi} (V_m \sin \theta)^2 d\theta \right]}$$

$$\sin^2 \theta = \frac{1 - \cos 2\theta}{2}$$

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

half-wave rectifier



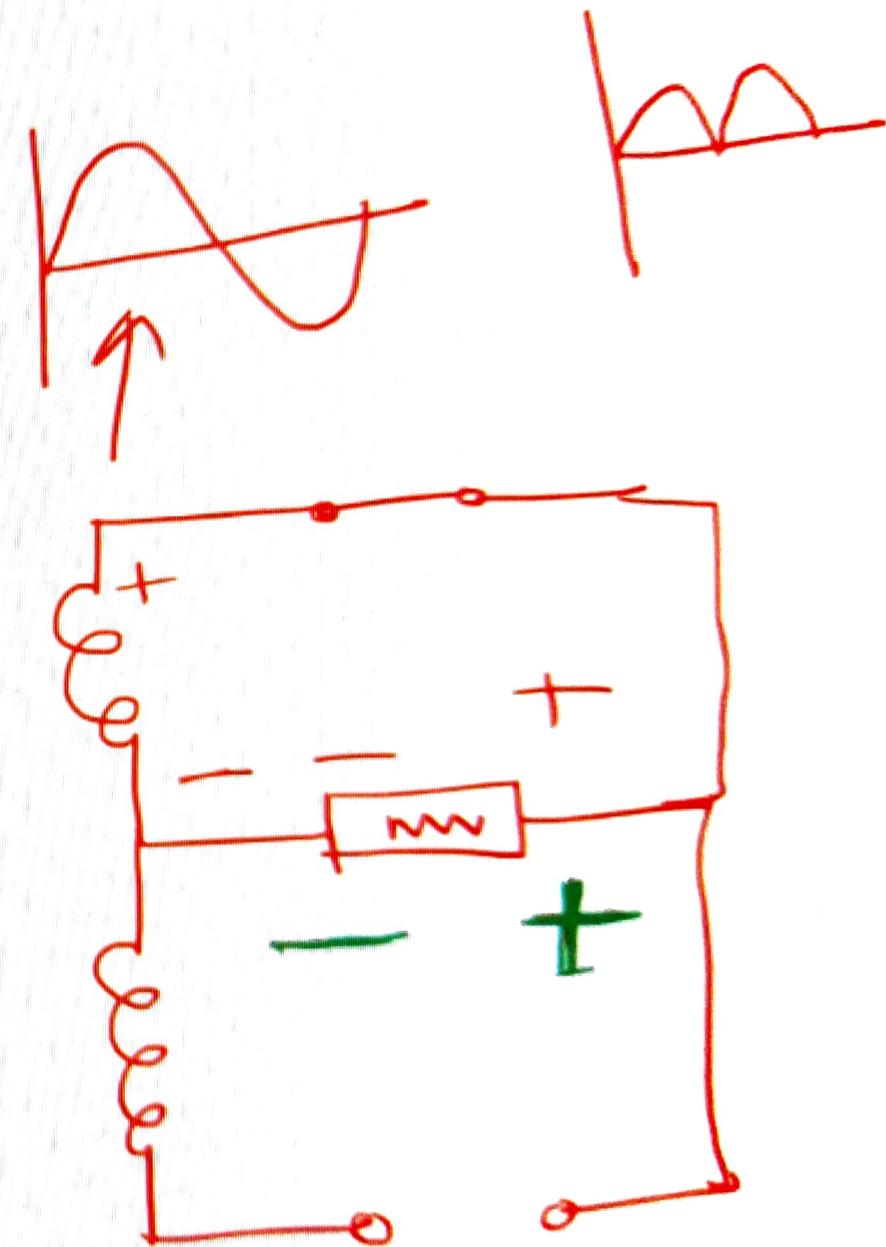
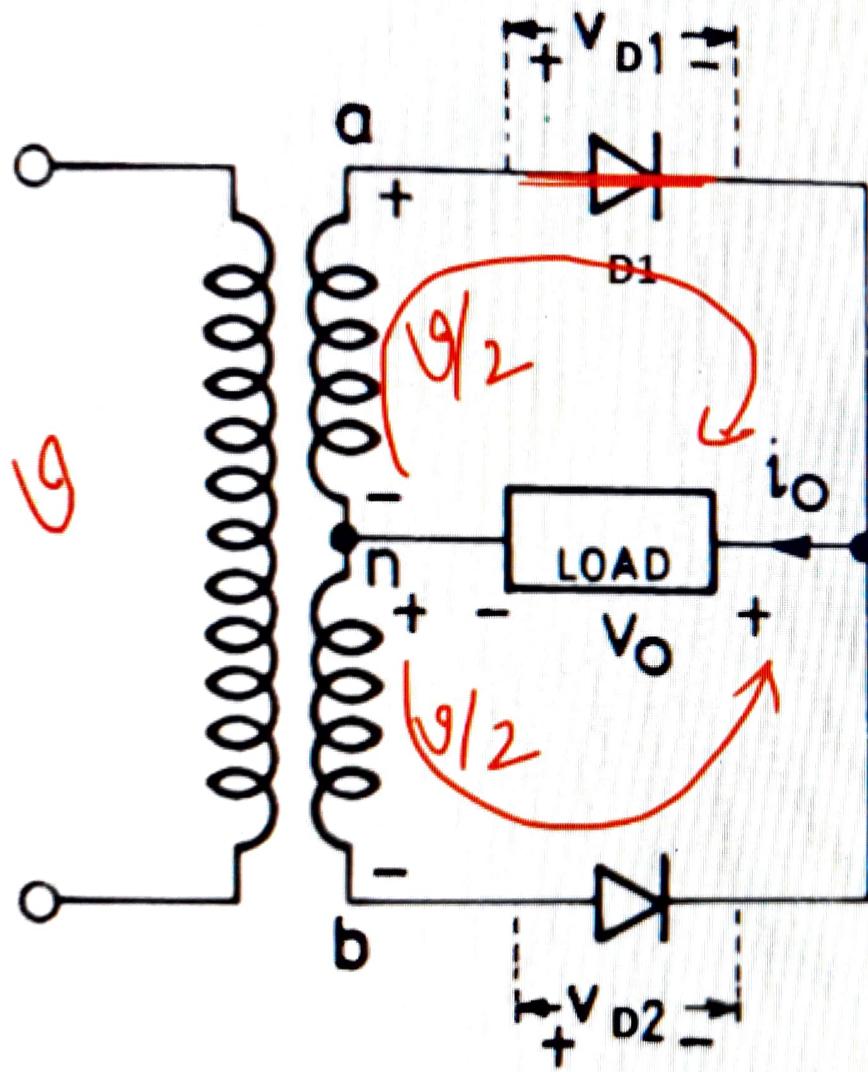
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$$V_{avg} = \frac{V_m}{\pi}$$

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

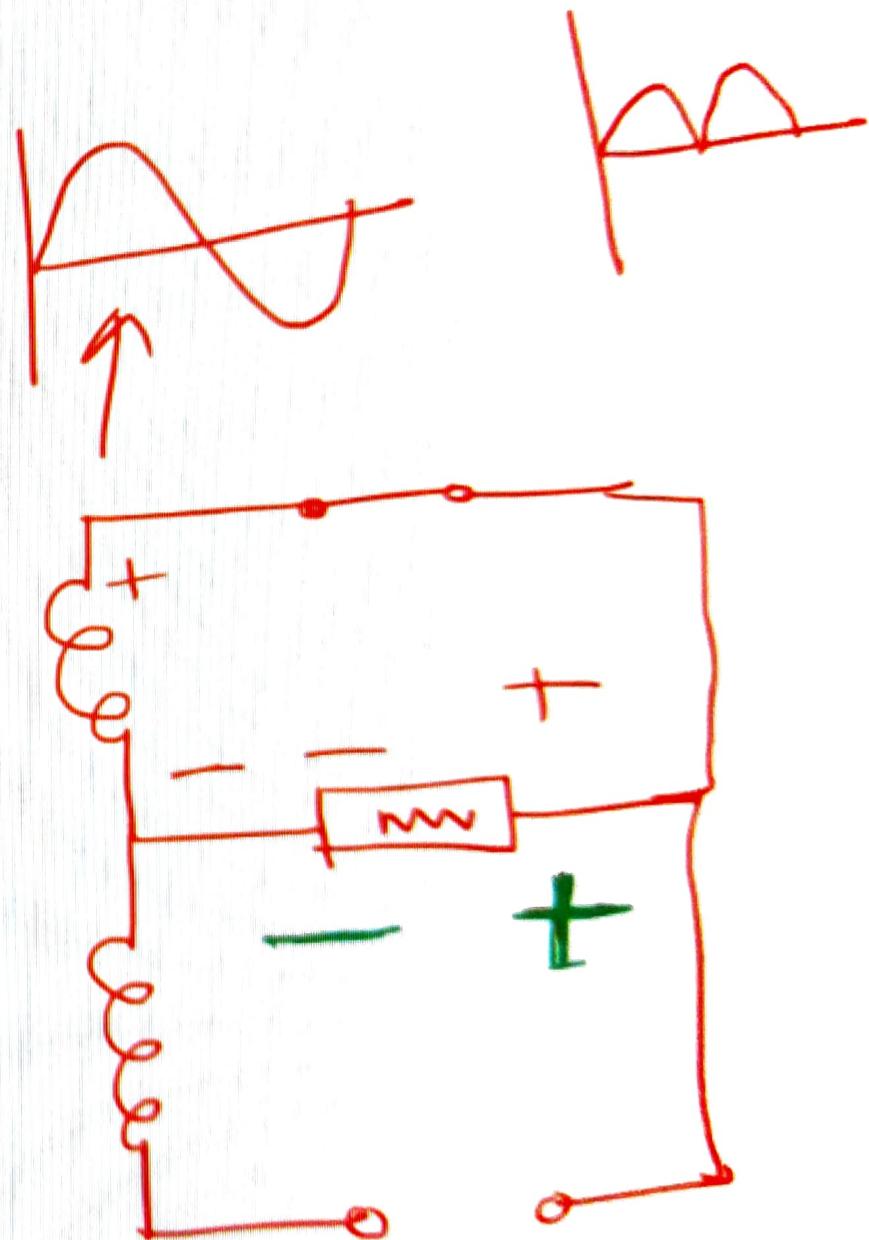
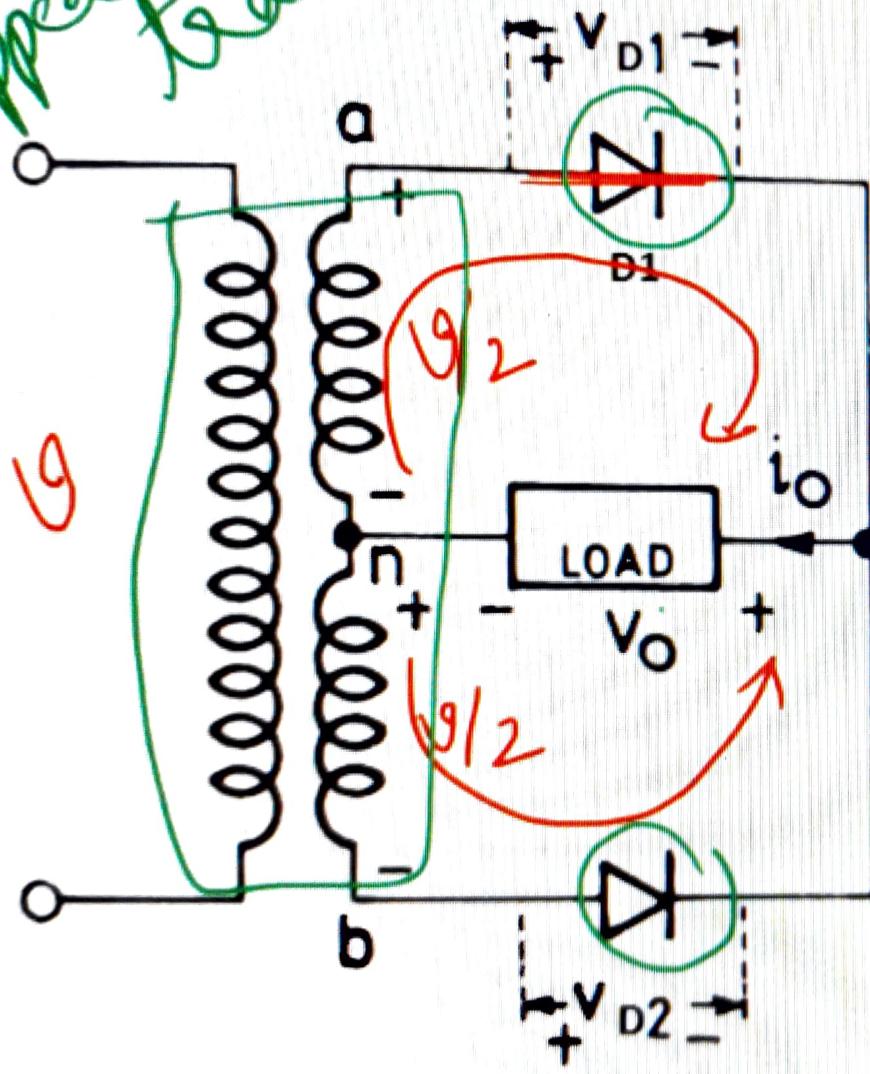
$$\eta = \frac{\text{Output power (DC)}}{\text{Input power (AC)}} = \frac{\frac{V_{avg}^2}{R_L}}{\frac{V_{rms}^2}{R_L}} = \frac{40.53\%}{R_L}$$

Full-wave rectifier



Full-wave rectifier

Center tapped transformer



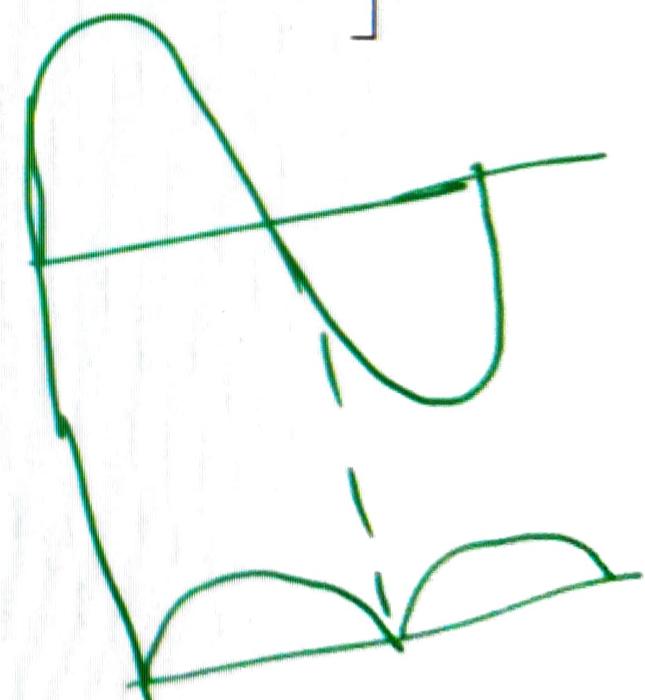
Full-wave rectifier

- RMS value of voltage at the output resistance

$$V_{rms} = \sqrt{\frac{1}{\pi} \left[\int_0^{\pi} v^2 d\theta \right]} = \sqrt{\frac{1}{\pi} \left[\int_0^{\pi} (V_m \sin \theta)^2 d\theta \right]}$$

$$\sin^2 \theta = \frac{1 - \cos 2\theta}{2}$$

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

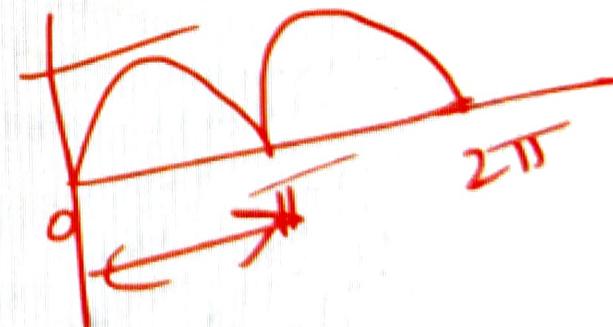


Full-wave rectifier

- Average value of voltage at the output resistance

$$V_{dc} = \frac{1}{\pi} \left[\int_0^{\pi} v d(\omega t) \right] = \frac{1}{\pi} \left[\int_0^{\pi} (V_m \sin \omega t) d(\omega t) \right]$$

$$V_{dc} = \frac{2V_m}{\pi}$$



$\pi \rightarrow$

Full-wave rectifier

- Ripple factor: indicates how close the rectifier output voltage to its DC value

$$\gamma = \sqrt{\left(\frac{V_{rms}}{V_{dc}}\right)^2 - 1} = 0.482$$

Full-wave rectifier

- Efficiency, η is the ratio of output power (dc) to input power (ac)

$$\eta = \frac{\text{Output power (DC)}}{\text{Input power (AC)}} = \frac{\frac{V_{dc}^2}{R_L}}{\frac{V_{rms}^2}{R_L}} = \underline{\underline{\frac{V_{dc}^2}{V_{rms}^2}}} = 81.2\%$$

Full-wave rectifier

- Form factor: ratio of the rms value of the output voltage to the average value of the output voltage

$$\text{Form factor} = \frac{\text{RMS value of output voltage}}{\text{Average value of output voltage}}$$

$$\text{Form factor} = \frac{\frac{V_m}{\sqrt{2}}}{\frac{2V_m}{\pi}} = 1.11$$

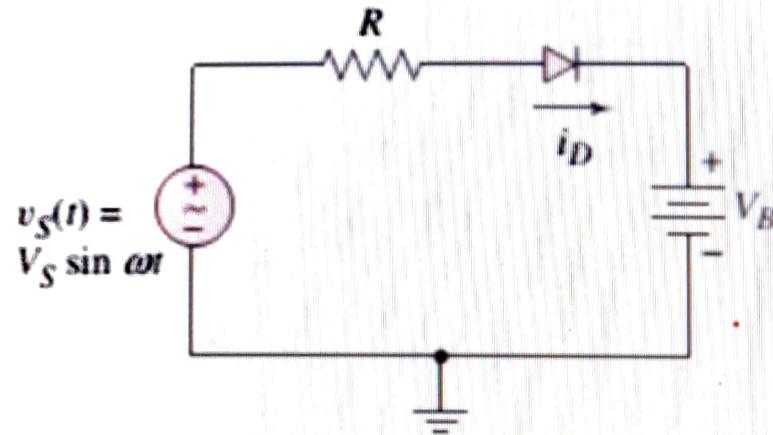
Full-wave rectifier

- Peak factor: the ratio of the peak value of the output voltage to the rms value of the output voltage

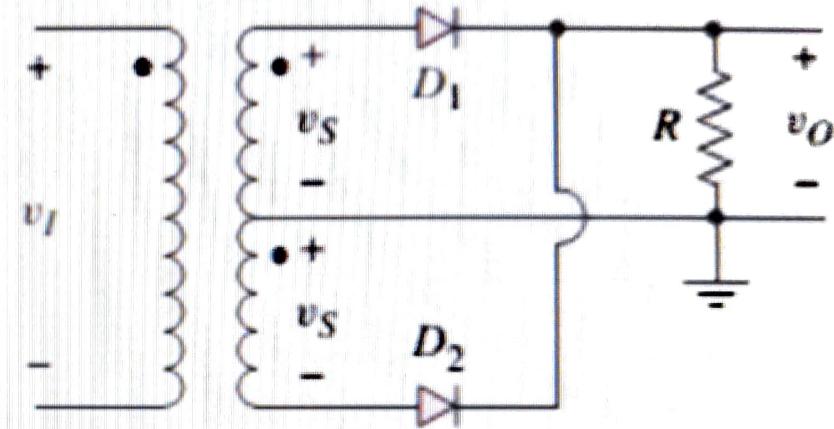
$$V_{pf} = \frac{\text{Peak value of output voltage}}{\text{RMS value of output voltage}} = \frac{V_m}{\underline{\underline{V_{rms}}}} = \underline{\underline{\sqrt{2}}}$$

✓.

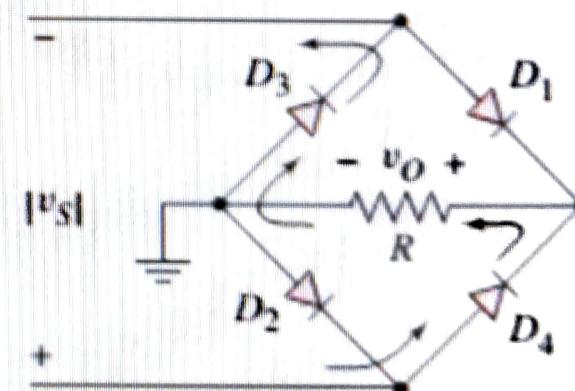
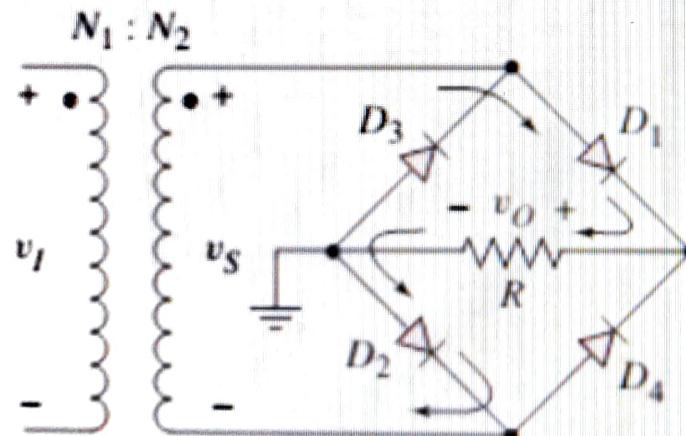
Diode rectifier circuits



Half wave rectifier



Full wave rectifier,
centre tapped transformer



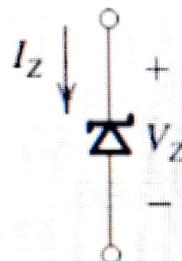
Full wave bridge rectifier

Passive filters

- To smoothen the ripple
 - Inductor filter
 - Capacitor filter
 - LC filter
 - CLC or pi filter

Voltage regulator

- Provides constant DC voltage to the circuit
- Zener diode is a voltage regulator



- The first integrated voltage regulator (μ A723, National LM100)

Regulated DC power supply/ Cell Phone Charger Circuit

