جامعـــة الأمـيـــر سطام بن عبدالعزيز
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COLLEGE OF ENGINEERING / DEPARTMENT OF ELECTRICAL ENGINEERING

الأستاذ الدكتور جوهر المعين/Professor Jaouhar MOUINE

Electronic Systems

Professor Jaouhar MOUINE
الأستاذ الدكتور جوهر المعين

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Chapter 1
Power Supplies

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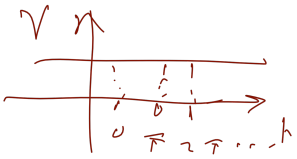

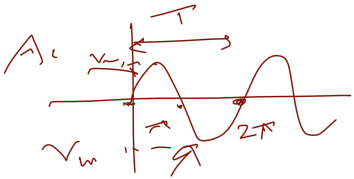

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Introduction

- Power supplies are required to power electronic equipments.
- The function of an electronic power supply unit is to convert the ac or dc line power into the required dc voltages according to the current demands of a particular system.
- A power supply circuit is usually built using:
  - Rectifiers to obtain a steady dc voltage from the ac voltage,
  - Filters to get a dc level,
  - Regulators to obtain a desired fixed dc voltage which remains the same even if the input dc voltage varies or the output load connected to the dc voltage changes.

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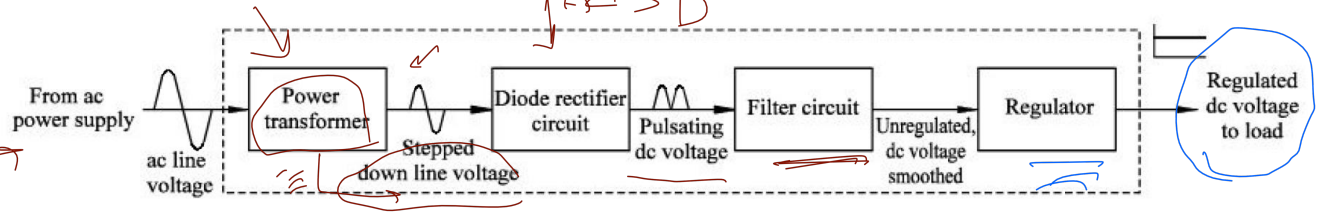
Power Supply



- The functional blocks required for conversion of ac input to dc output voltage in an electronic power supply unit are **a power transformer, a diode rectifier circuit, a filter circuit and a regulator.**
- The power transformer steps down the ac voltage to about the desired voltage. The rectifier converts the ac voltage from the transformer into a pulsating dc voltage. The filter smoothes out the pulsating dc voltage. Finally, the regulator maintains a constant output regardless of variations in ac voltage or the current required by the load or both.

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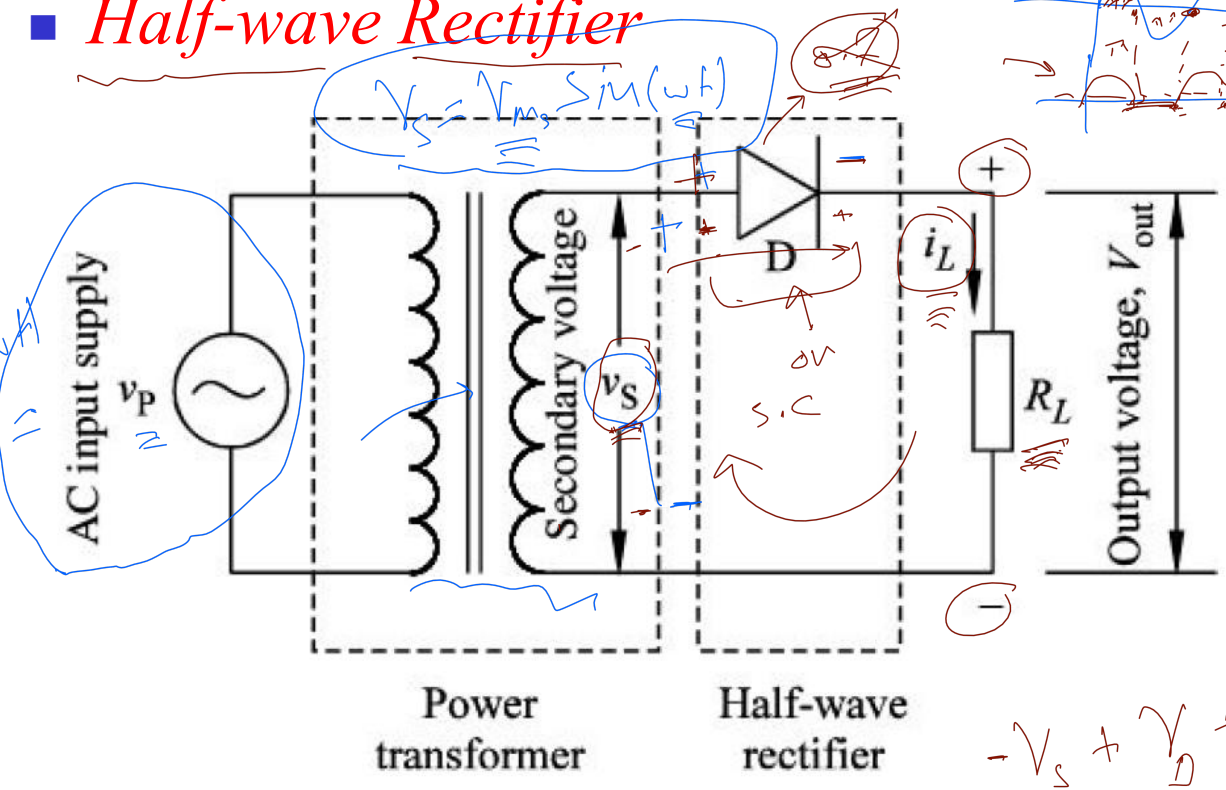
Rectifier

- *Half-wave Rectifier*



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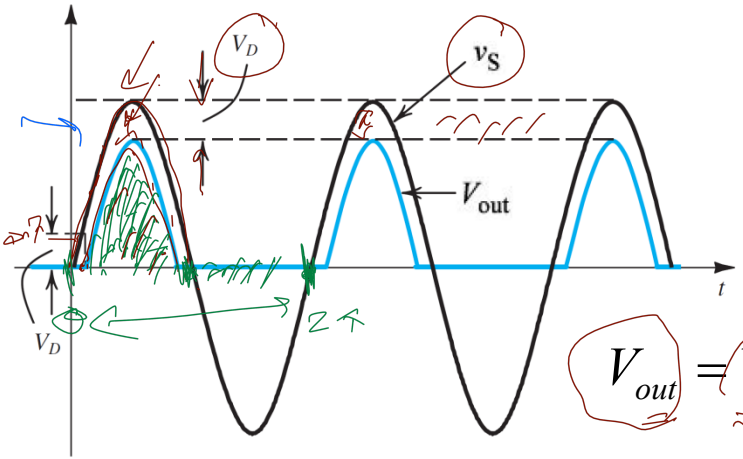
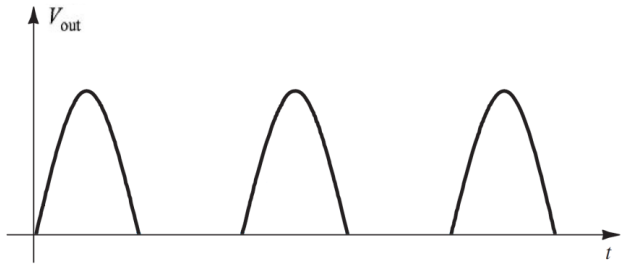
Rectifier

- *Half-wave Rectifier (cont'd)*





$$V_{out} = V_{out\,dc} + V_{out\,ac} = V_{out\,av} + V_{out\,ripple}$$

$$v_S = V_m \sin \omega t$$

$$V_{out\,dc} = \frac{1}{2\pi}\int_0^{2\pi} V_{out}(\omega t)\, d\omega t = \frac{V_m}{\pi}$$

$$V_{out\,rms} = \sqrt{\frac{1}{2\pi}\int_0^{2\pi} V_{out}^2(\omega t)\, d\omega t} = \frac{V_m}{2}$$

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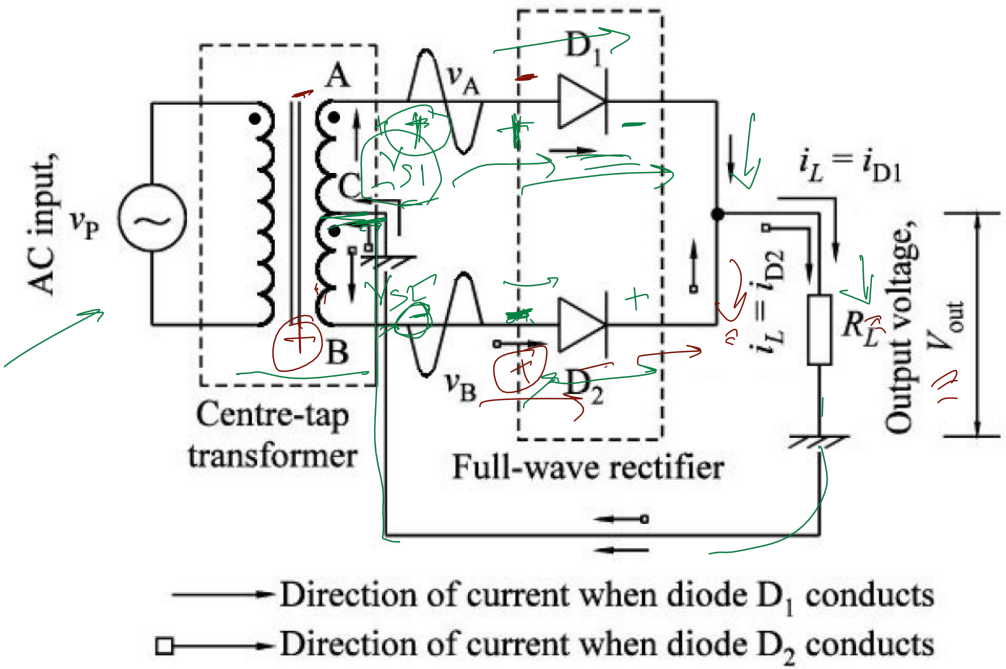
Rectifier

- *Full-wave Rectifier Using Centre-tap Transformer*



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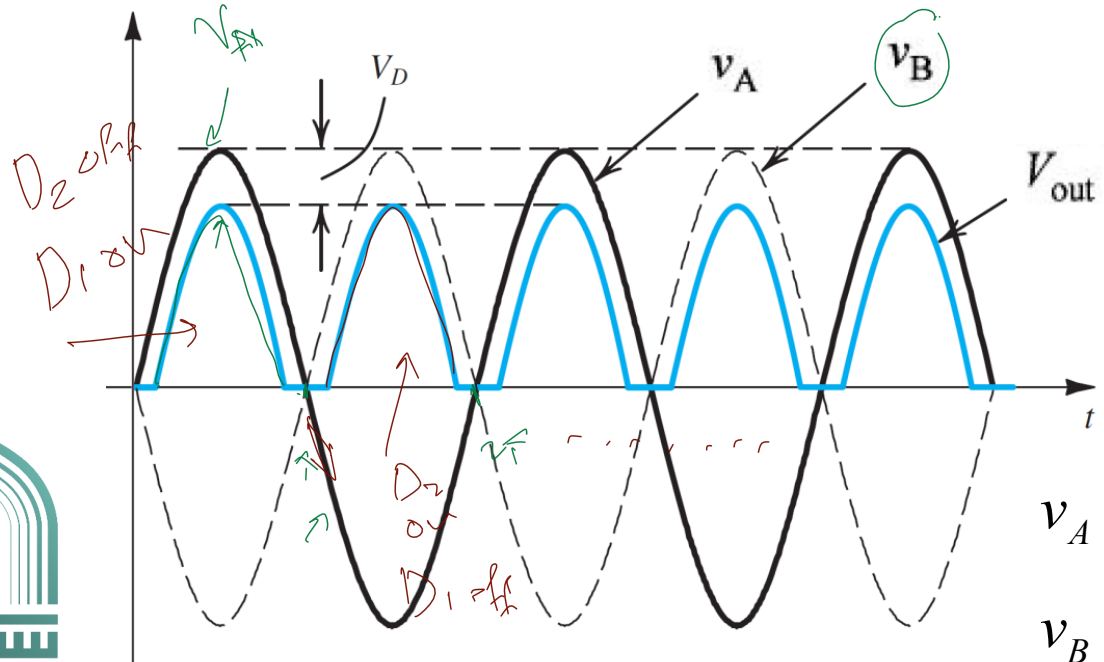
Rectifier

- *Full-wave Rectifier Using Centre-tap Transformer (cont'd)*



$$v_A = V_m \sin \omega t$$

$$v_B = -V_m \sin \omega t$$

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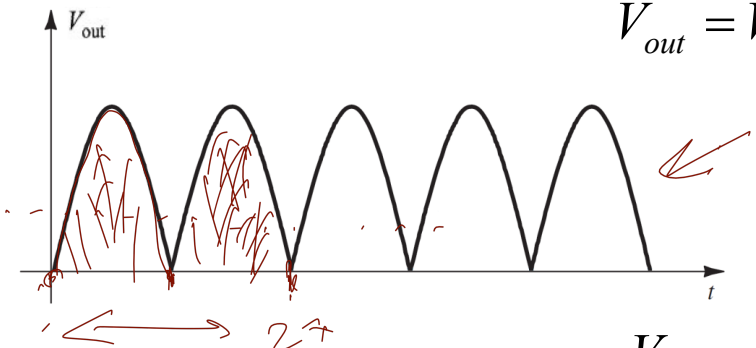
Rectifier

- *Full-wave Rectifier Using Centre-tap Transformer (cont'd)*



$$V_{out} = V_{out\,dc} + V_{out\,ac} = V_{out\,av} + V_{out\,ripple}$$

$$V_{out\,dc} = \frac{1}{2\pi}\int_0^{2\pi} V_{out}(\omega t)\, d\omega t = \frac{2V_m}{\pi}$$

$$V_{out\,rms} = \sqrt{\frac{1}{2\pi}\int_0^{2\pi} V_{out}^2(\omega t)\, d\omega t} = \frac{V_m}{\sqrt{2}}$$

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