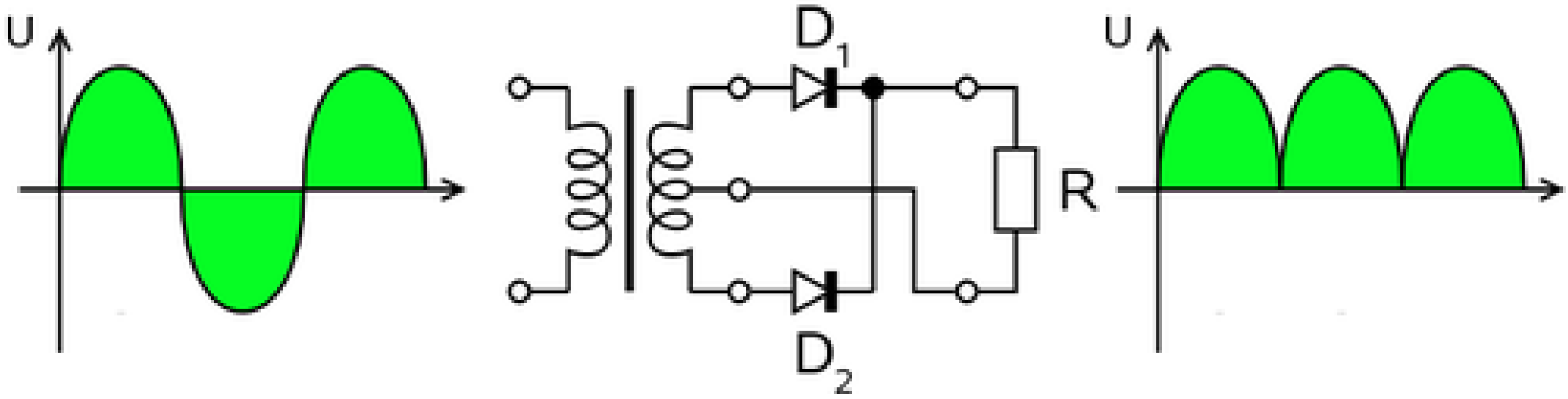
# Full Wave Rectifier

**Semiconductor Devices and Circuits**

**(ECE 181302)**

12th November 2021

# Full Wave Rectifier Using Transformer and 2 Diodes

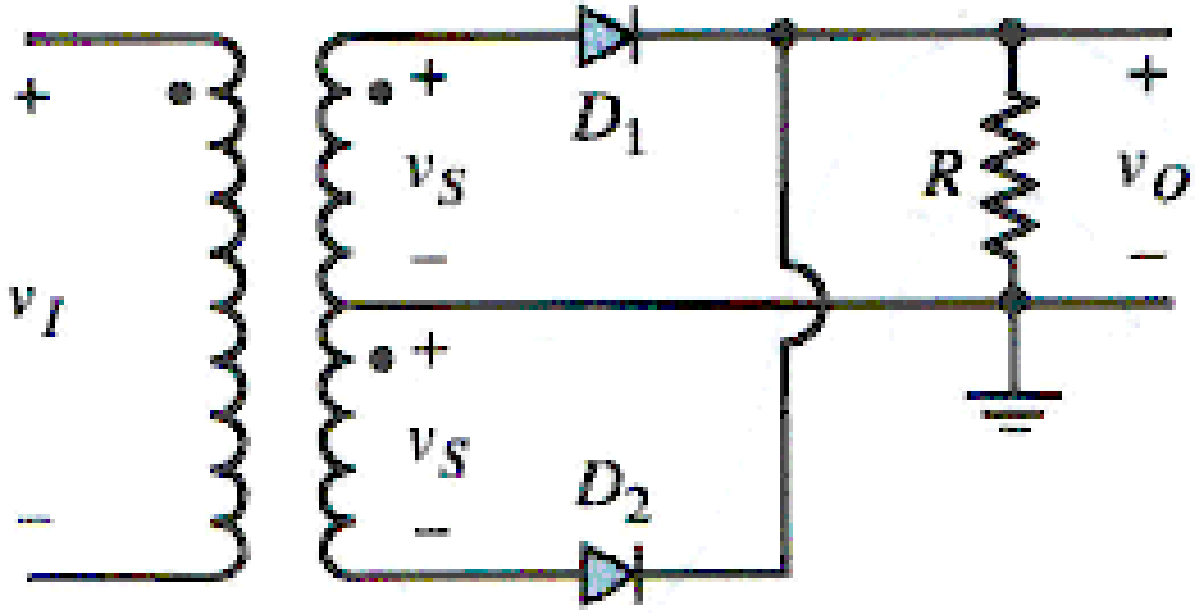


# Full-Wave Rectification with Center-Tapped Transformer

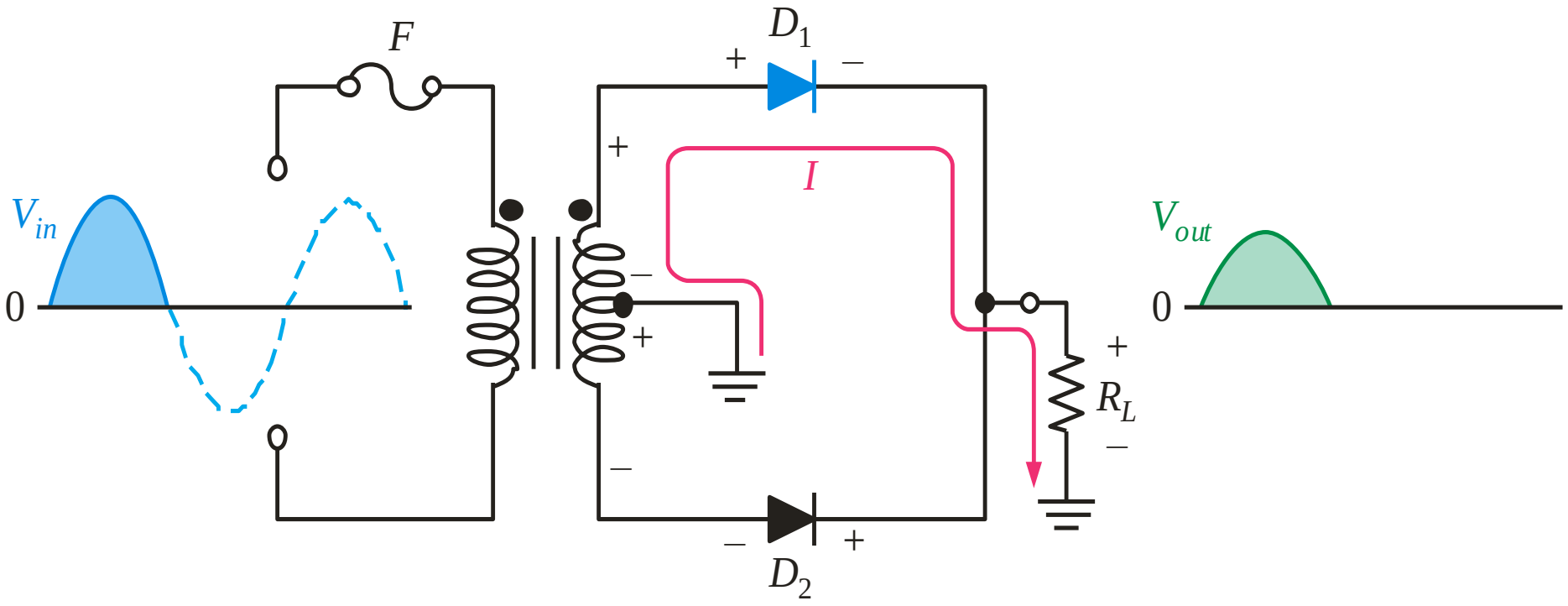
- *Positive cycle*, D2 off, D1 conducts;

  Vo – Vs + Vγ = 0

  **Vo = Vs - Vγ**



During the positive half-cycle, the upper diode is forward-biased and the lower diode is reverse-biased.

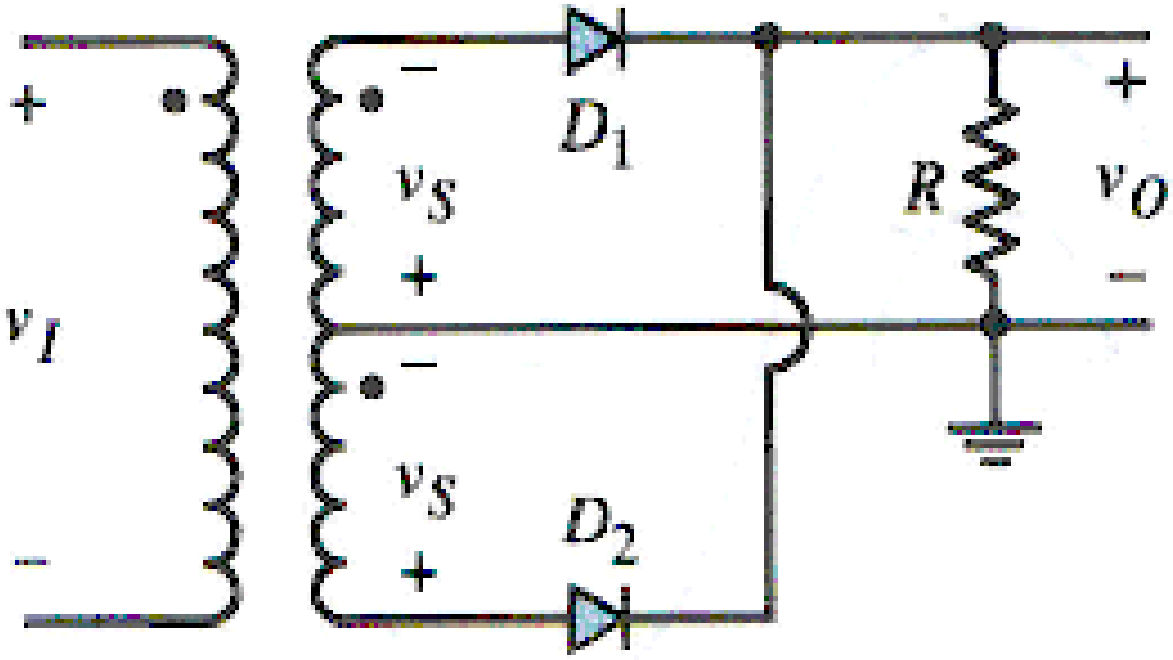


# Full-Wave Rectification with Center-Tapped Transformer

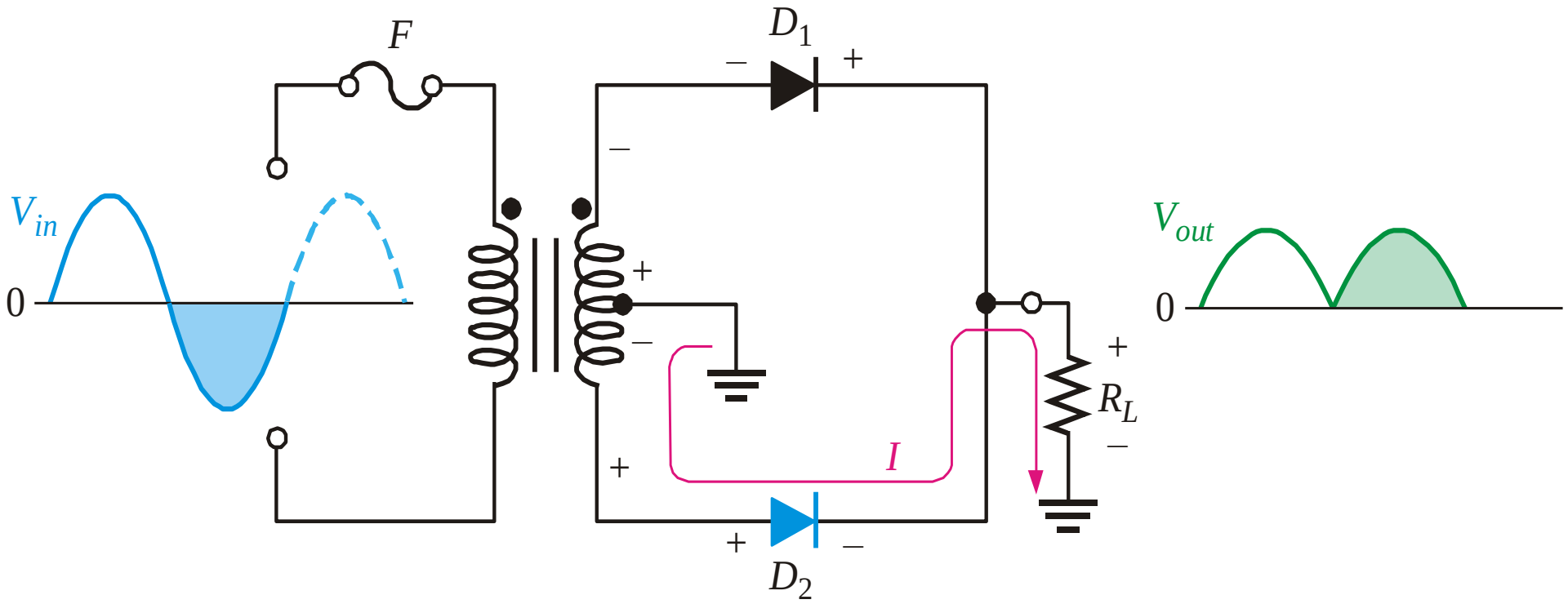
- *Negative cycle*, D1 off, D2 conducts;

Vo – Vs + Vγ = 0

**Vo = Vs - Vγ**



During the negative half-cycle, the lower diode is forward-biased and the upper diode is reverse-biased.



- *Positive cycle*, D2 off, D1 conducts;

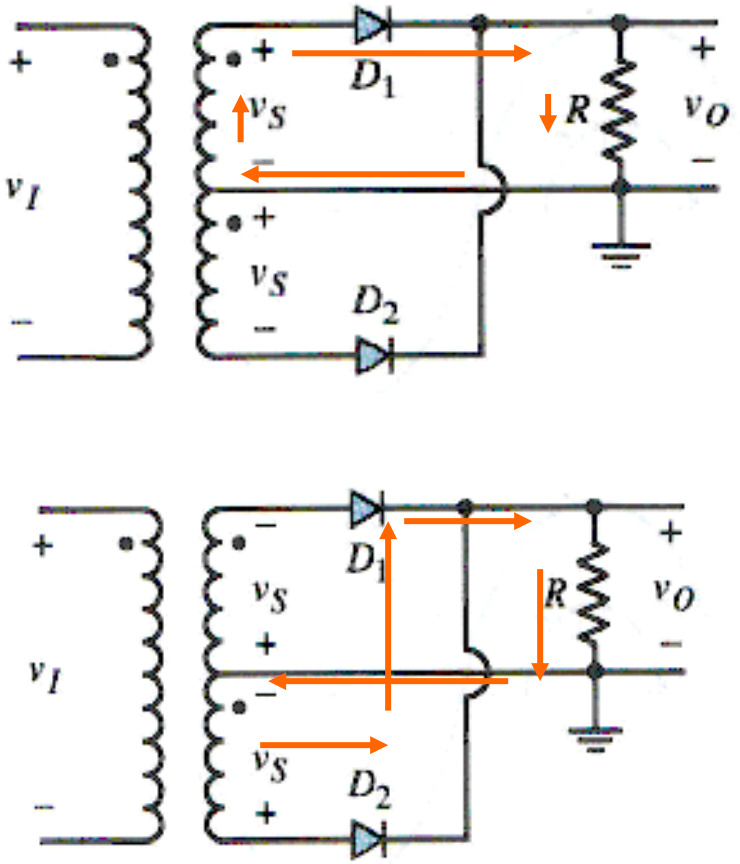
  Vo – Vs + Vγ = 0

  **Vo = Vs - Vγ**

- *Negative cycle,* D1 off, D2 conducts;

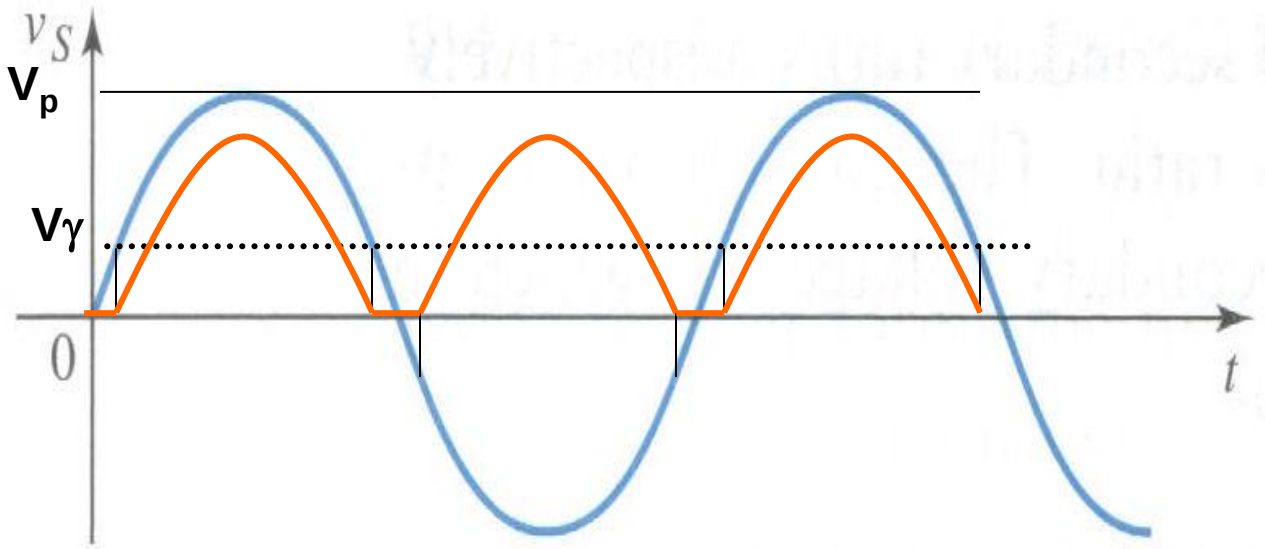
  Vo – Vs + Vγ = 0

  **Vo = Vs - Vγ**




- Since a rectified output voltage occurs during both positive and negative cycles of the input signal, this circuit is called a **full-wave rectifier**.
- Also notice that the **polarity of the output voltage for both cycles is the same**

# $V_s = V_p \sin \omega t$



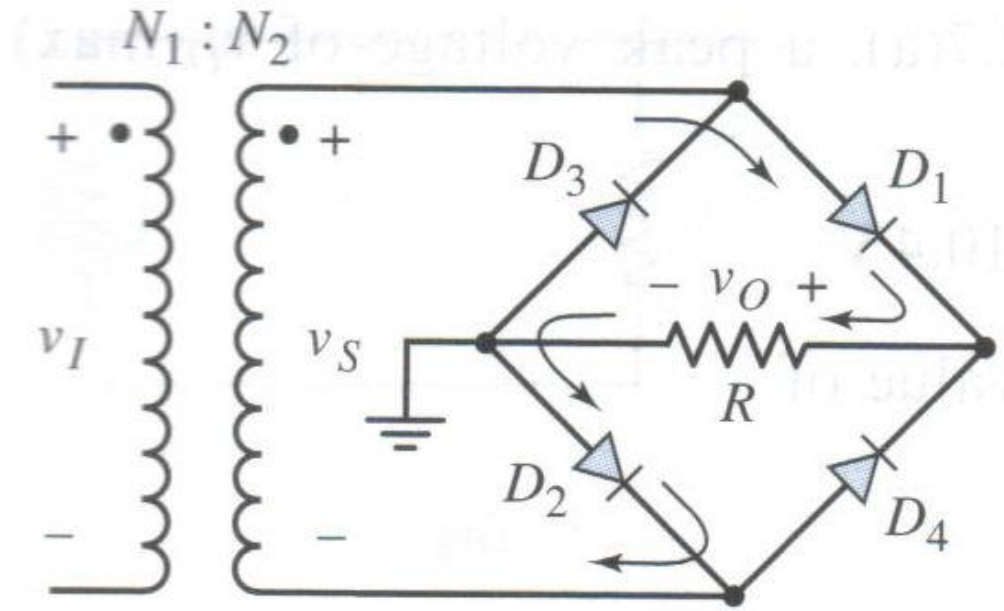

- Notice that the peak voltage of Vo is lower since **Vo = Vs - Vγ**
- **Vs < Vγ**, diode off, **open circuit**, no current flow, **<u>Vo = 0V</u>**

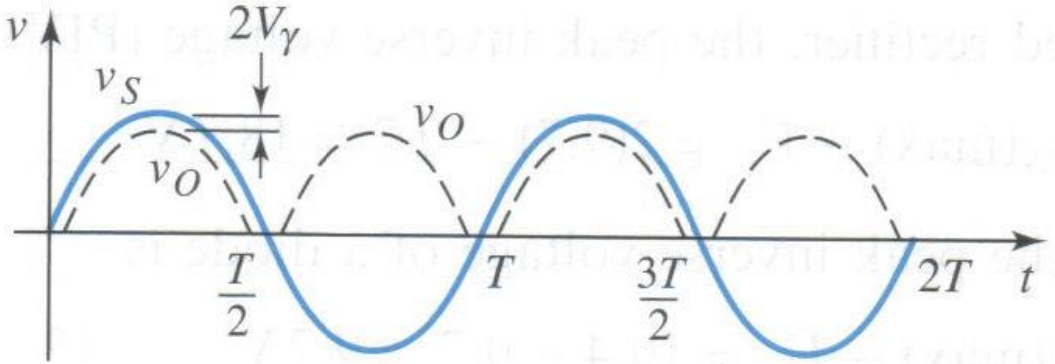
# Full-Wave Rectification with Bridge Rectifier

- **Positive cycle**, $D_1$ and $D_2$ conducts, $D_3$ and $D_4$ off;

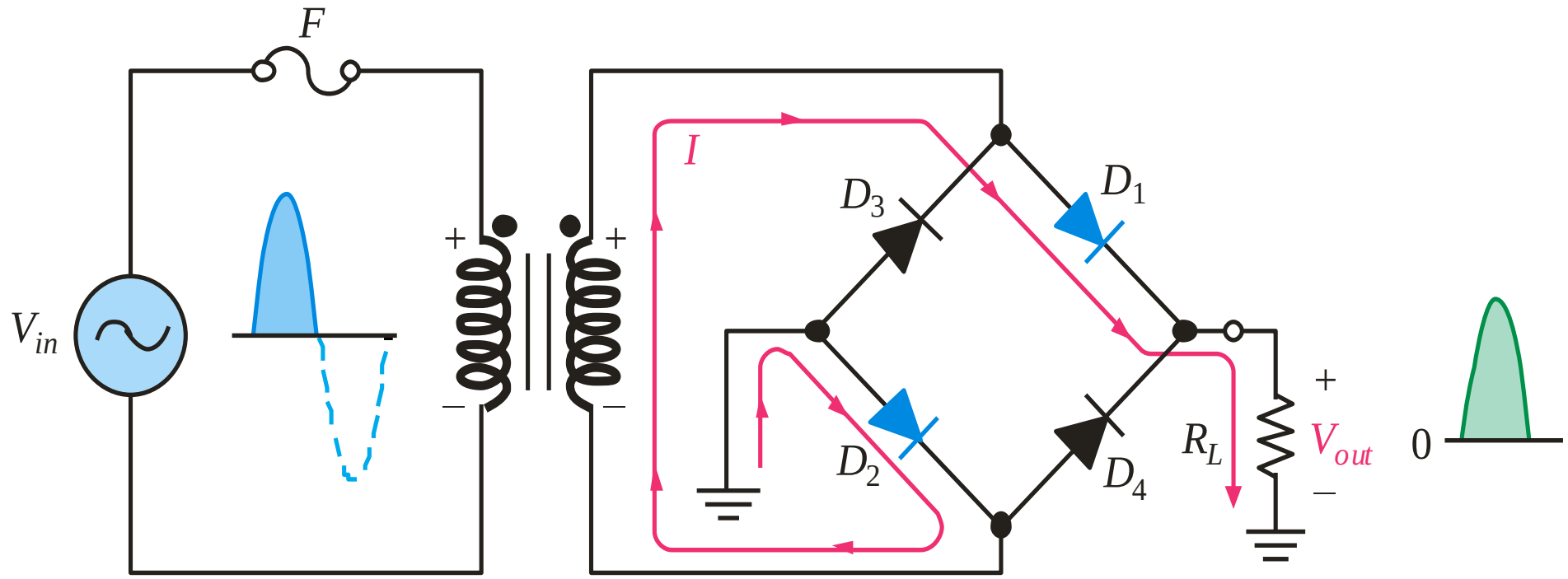
  + Vγ + Vo + Vγ – Vs = 0

  **<u>Vo = Vs - 2Vγ</u>**



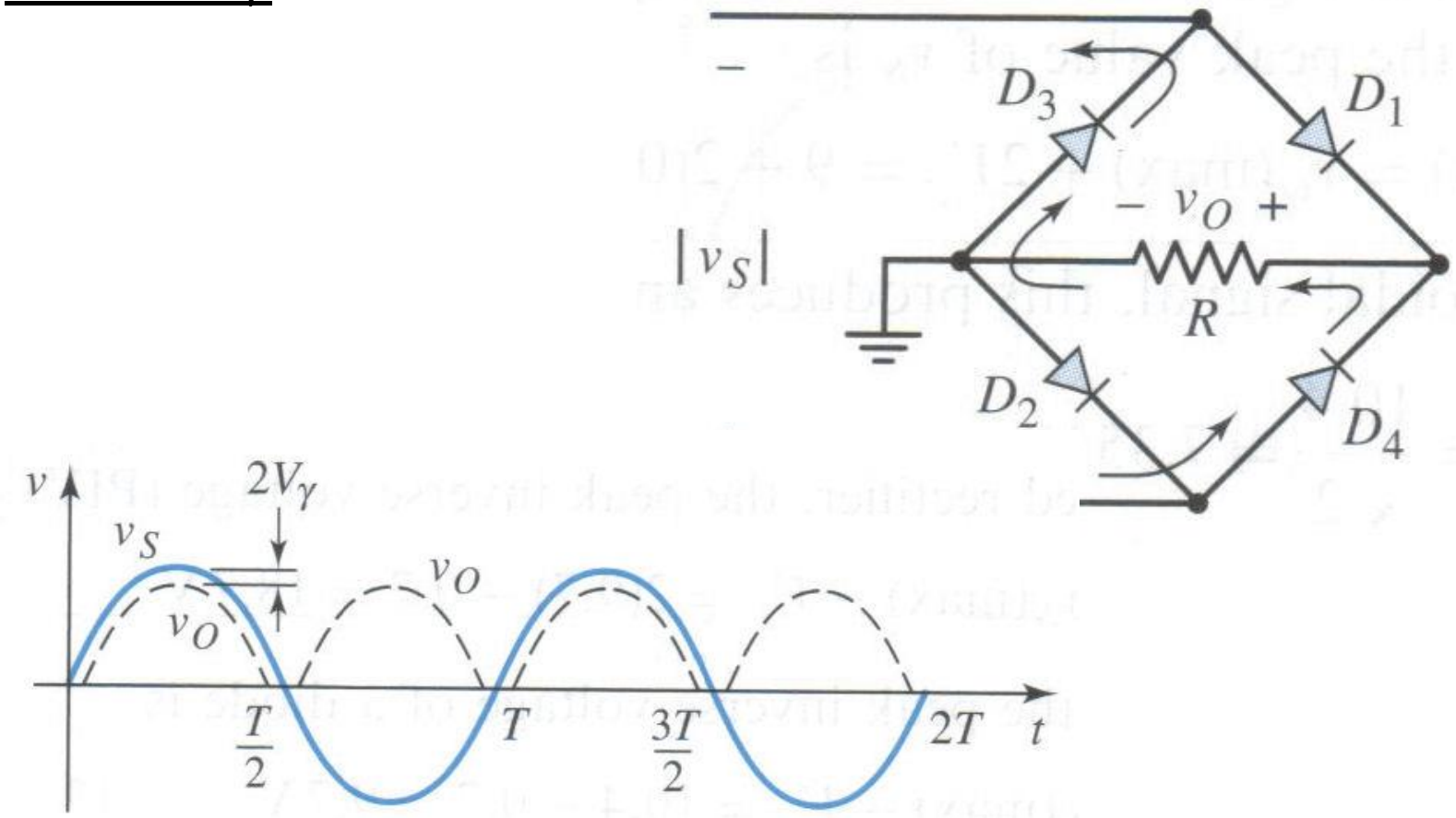



# Conduction path for the positive half-cycle.

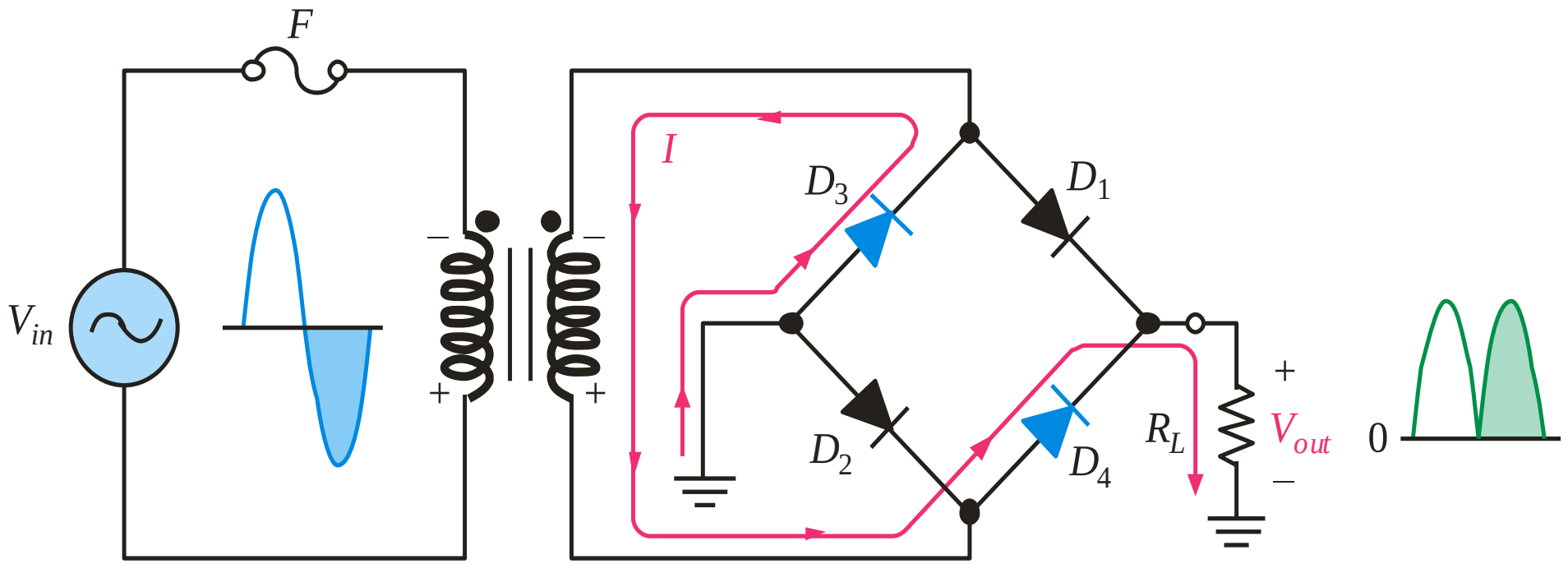


# Full-Wave Rectification with Bridge Rectifier

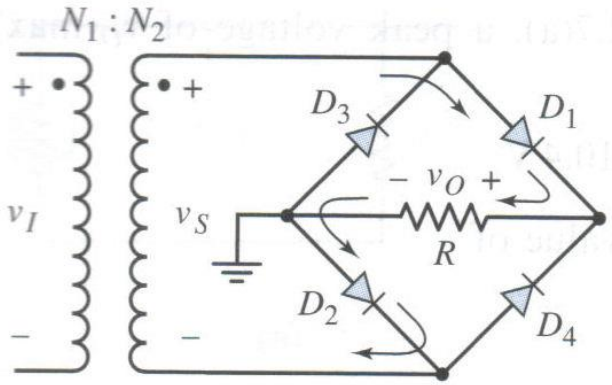
- **Negative cycle**, *D3* and *D4* conducts, *D1* and *D2* off
  + Vγ + Vo + Vγ – Vs = 0
  **<u>Vo = Vs - 2Vγ</u>**

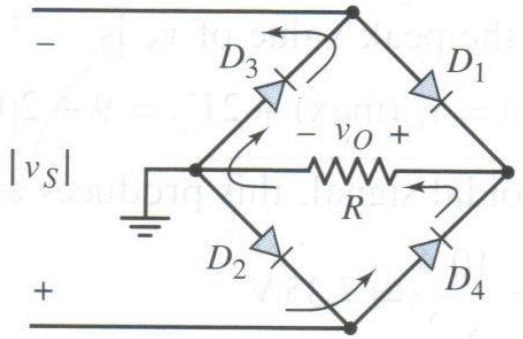


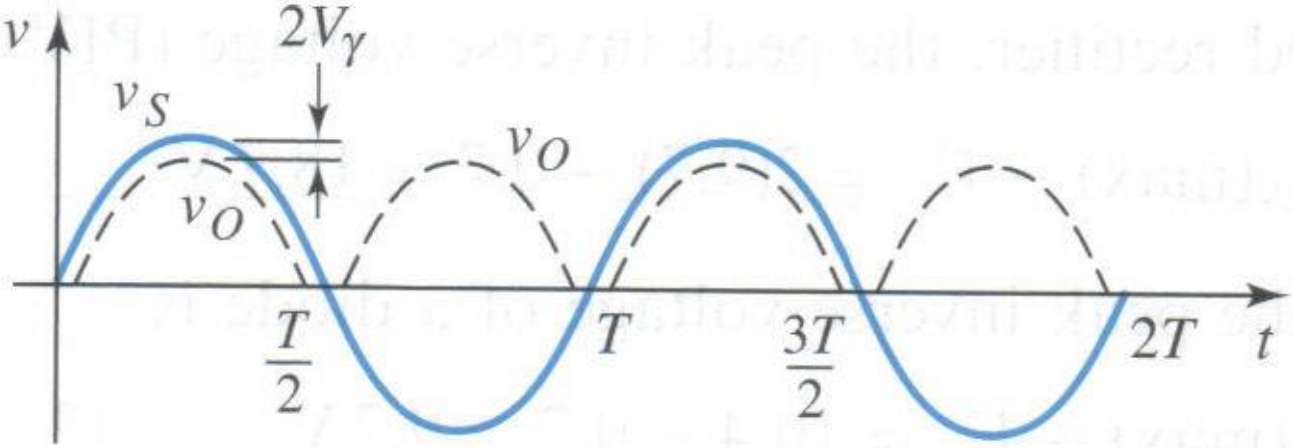
# Conduction path for the negative half-cycle.



# Full-Wave Rectification with Bridge Rectifier




- Also notice that the **polarity of the output voltage for both cycles is the same**

# References:


- Microelectronic Circuits, 7th edition by Adel S. Sedra Kenneth C. Smith.
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