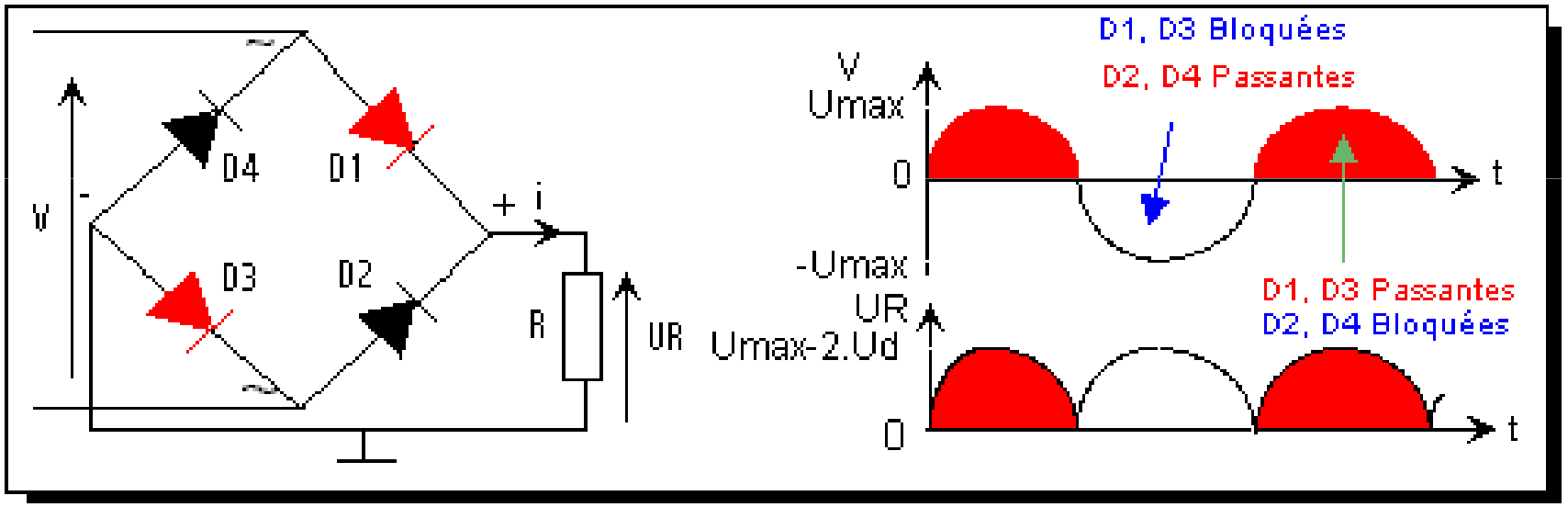
تطبيقات الديود

Diode Applications



Diode Applications

1. مقدمة

يُستخدم الثنائي العادي في العديد من التطبيقات والتي سنعرض منها:

1) تقويم الإشارة الجيبية: Rectification

2) دارات القص: Diode Limiting Circuits (Clippers)

3) دارات الإزاحة: Diode Clamping Circuits (Clampers)

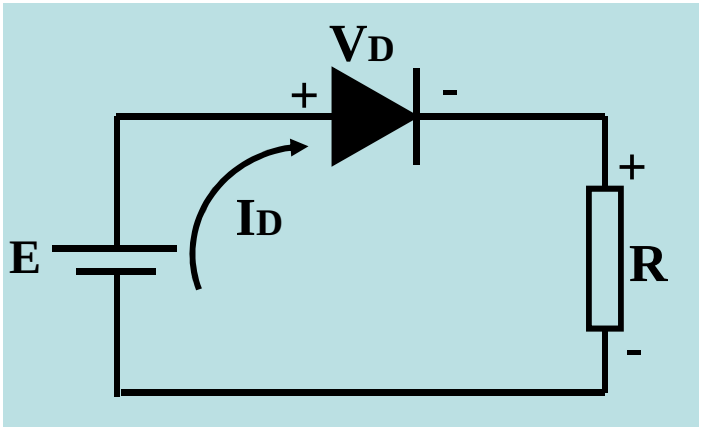
4) دارات التبديل بالثنائي: Diode Switching

يوجد أيضاً مجموعة من الثنائيات الخاصة المستخدمة في تطبيقات محددة والتي سندرس منها ثنائي زينر

Diode Applications

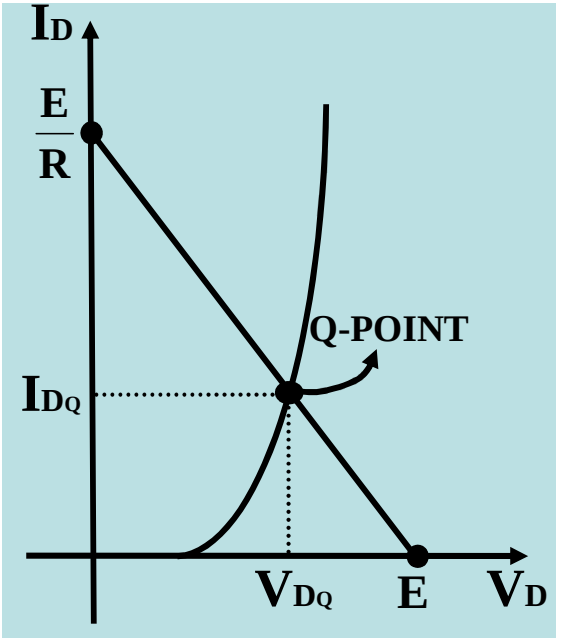
2. خط الحمل

هو خط مستقيم يمثل الحمل المطبق على الثنائي، يحدد تقاطعه مع منحني الخواص نقطة التشغيل للنظام



الحل البياني

$$E - V_D - V_R = 0$$
$$E = V_D + I_D R$$
$$I_D = -\frac{1}{R}(V_D - E)$$
$$V_D = 0 \Rightarrow I_D = \frac{E}{R}$$
$$I_D = 0 \Rightarrow V_D = E$$

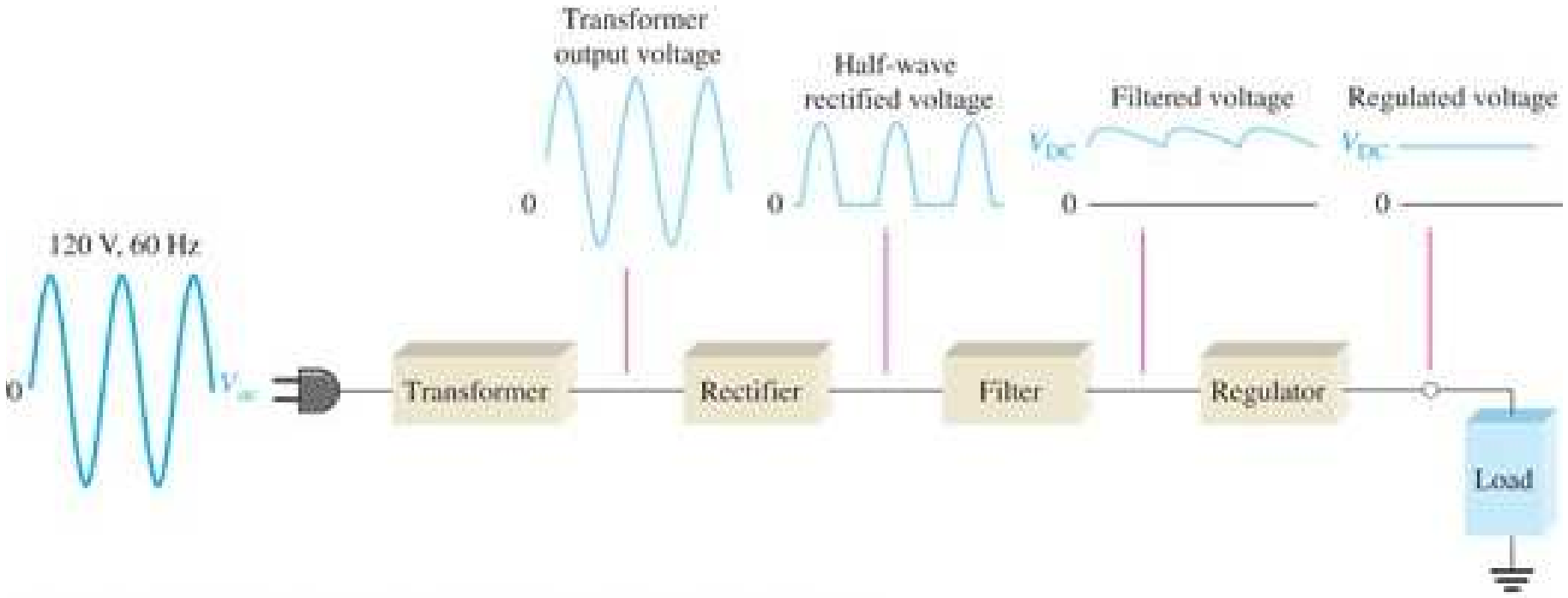


الحل الرياضي

$$E = V_D + I_D R$$
$$I_D = I_S\left(e^{\frac{KV_D}{T}} - 1\right)$$

Diode Applications

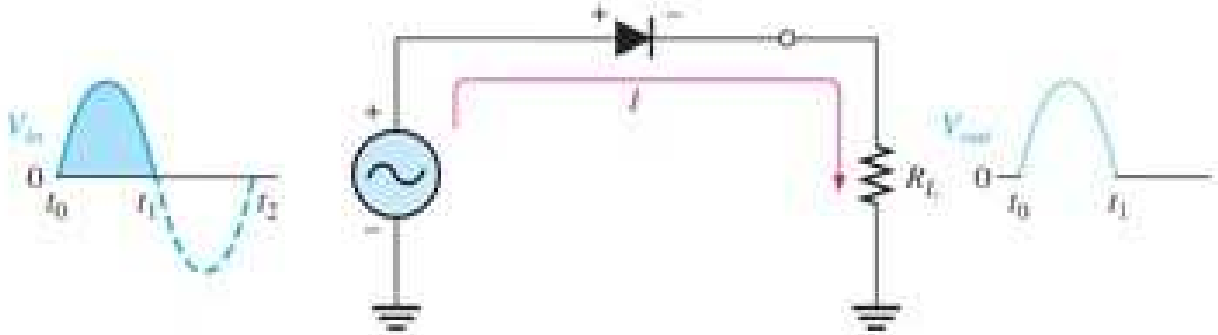
3. تقويم الإشارة الجيبية: Rectification



(a) Complete power supply with transformer, rectifier, filter, and regulator

Diode Applications

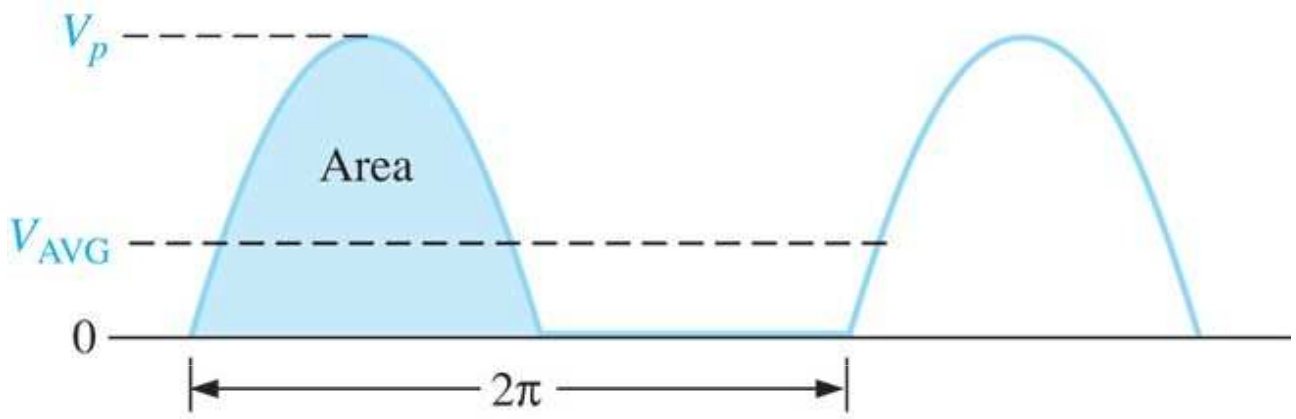
■ مقوم نصف الموجة: Half wave Rectifier



(a) During the positive alternation of the 60 Hz input voltage, the output voltage looks like the positive half of the input voltage. The current path is through ground back to the source.

(b) During the negative alternation of the input voltage, the current is 0, so the output voltage is also 0.

Diode Applications



$$v_i = V_m \sin \omega t$$

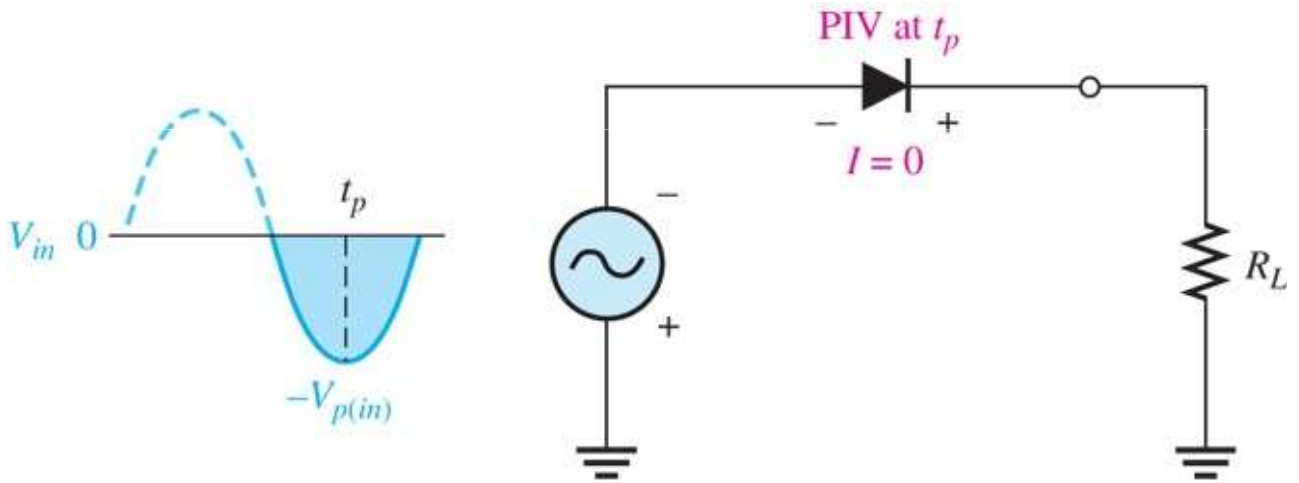
$$V_{AVG} = \frac{1}{T}\int_0^{T/2} V_m \sin\frac{2\pi t}{T}\,dt = \frac{V_m}{\pi} = 0.318 \times V_m$$

$$V_P = V_m - 0.7$$

Diode Applications

■ جهد القمة العكسي: Peak Inverse Voltage

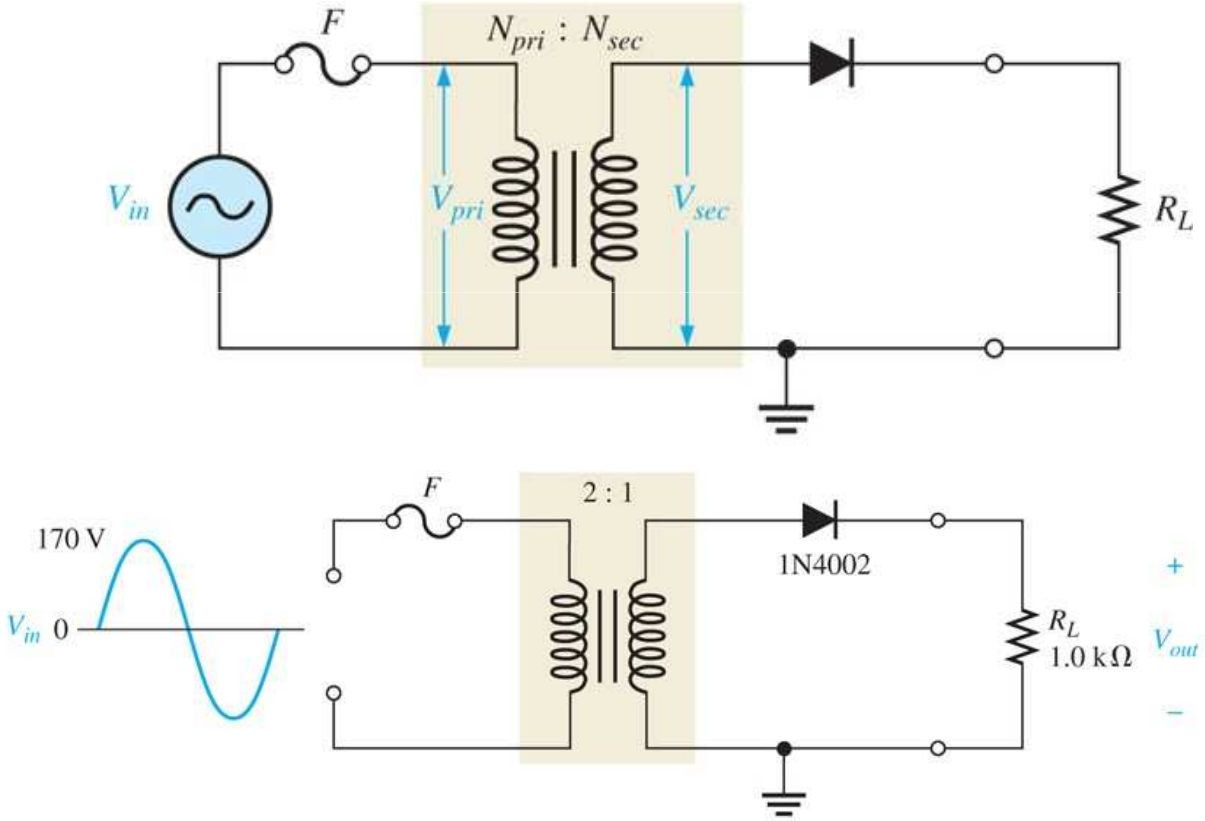
هو جهد الانحياز العكسي الأعظم الذي يطبق على الديود أثناء عمله في دارة ما



$$PIV = V_K - V_A$$

Diode Applications

- مقوم نصف الموجة بمحولة جهد:



Diode Applications

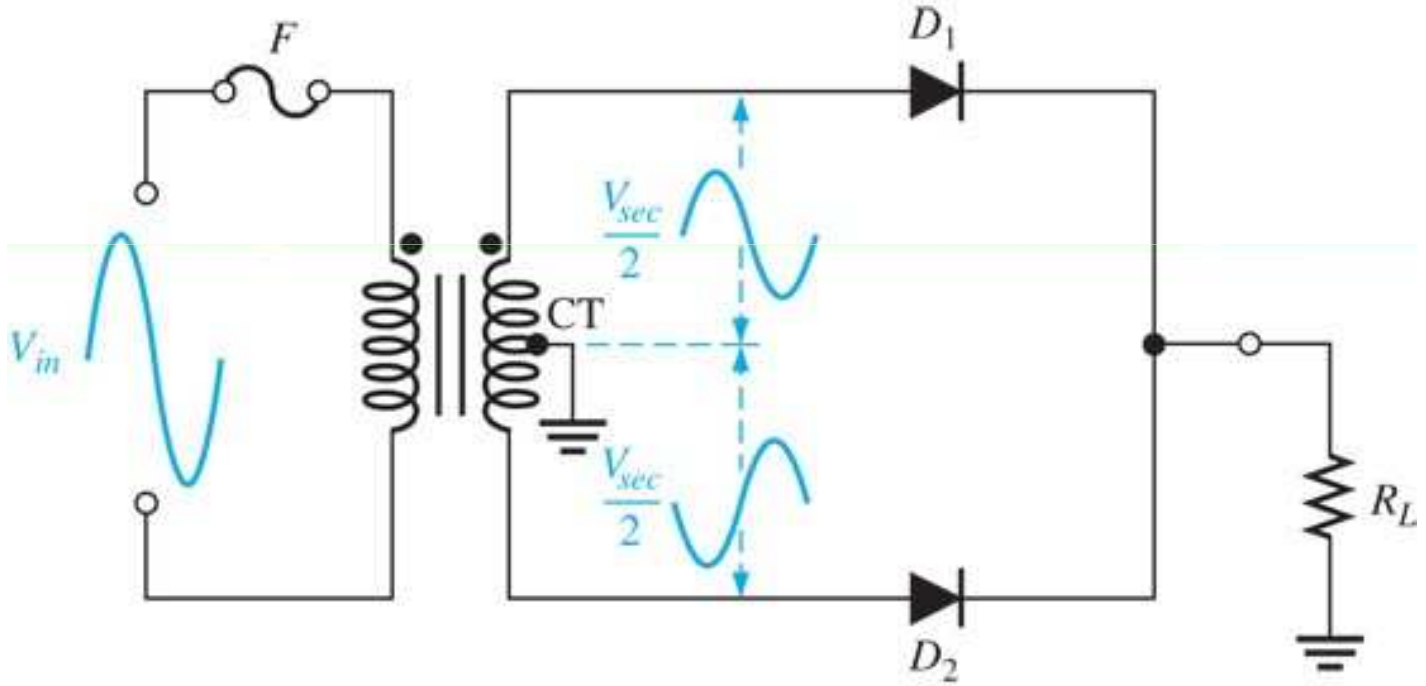
■ مقوم الموجة الكاملة: Full wave Rectifier

$$v_i = V_m \sin \omega t$$

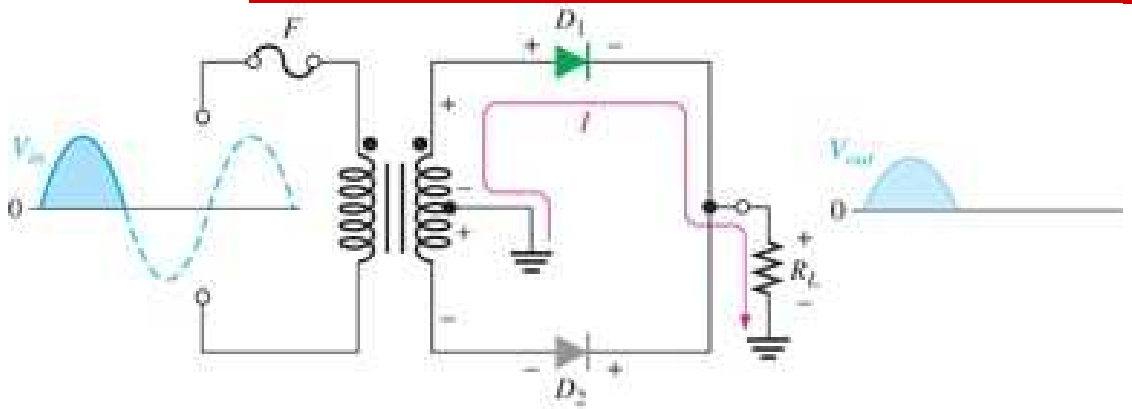
$$V_{AVG} = \frac{1}{T}\int_0^T V_m \sin\frac{2\pi t}{T}\,dt = \frac{2V_m}{\pi} = 0.636 \times V_m$$

Diode Applications

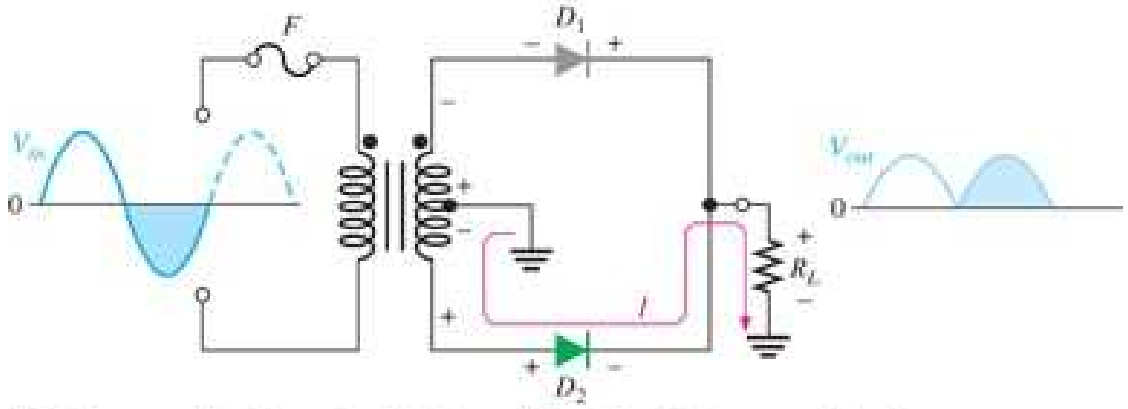
- مقوم الموجة الكاملة باستخدام محول ذو نقطة وسط وديودين:



Diode Applications

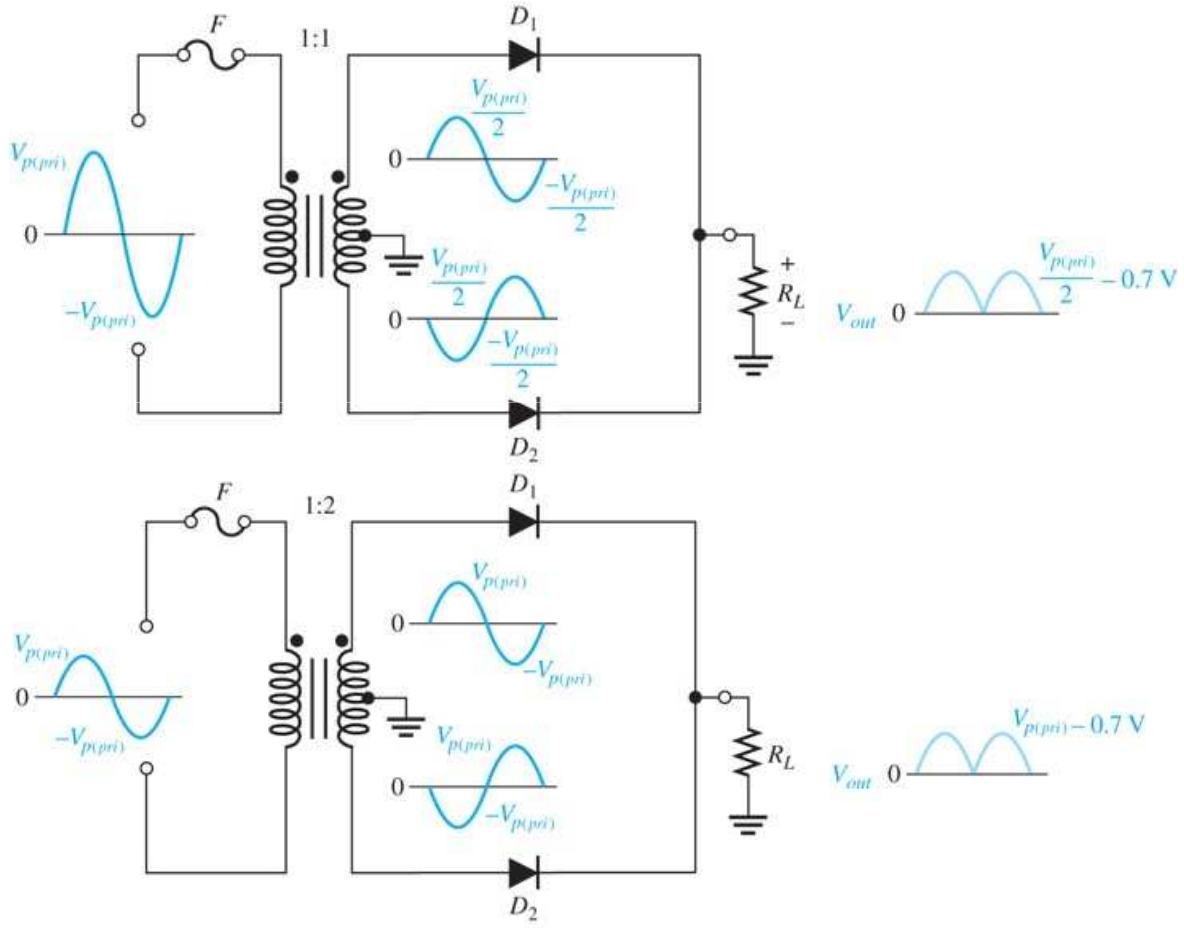


(a) During positive half-cycles, D_1 is forward-biased and D_2 is reverse-biased.

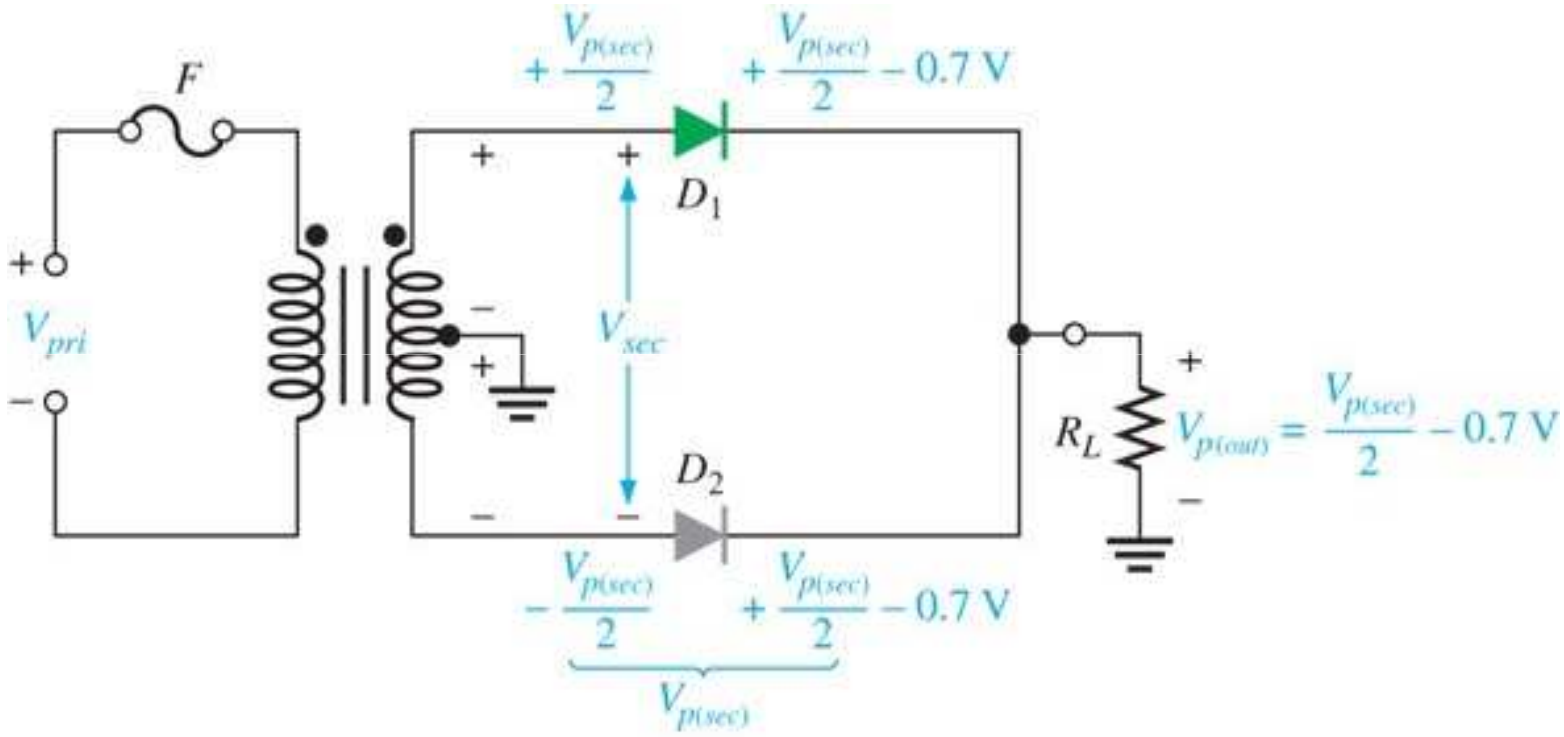


(b) During negative half-cycles, D_2 is forward-biased and D_1 is reverse-biased.

Diode Applications

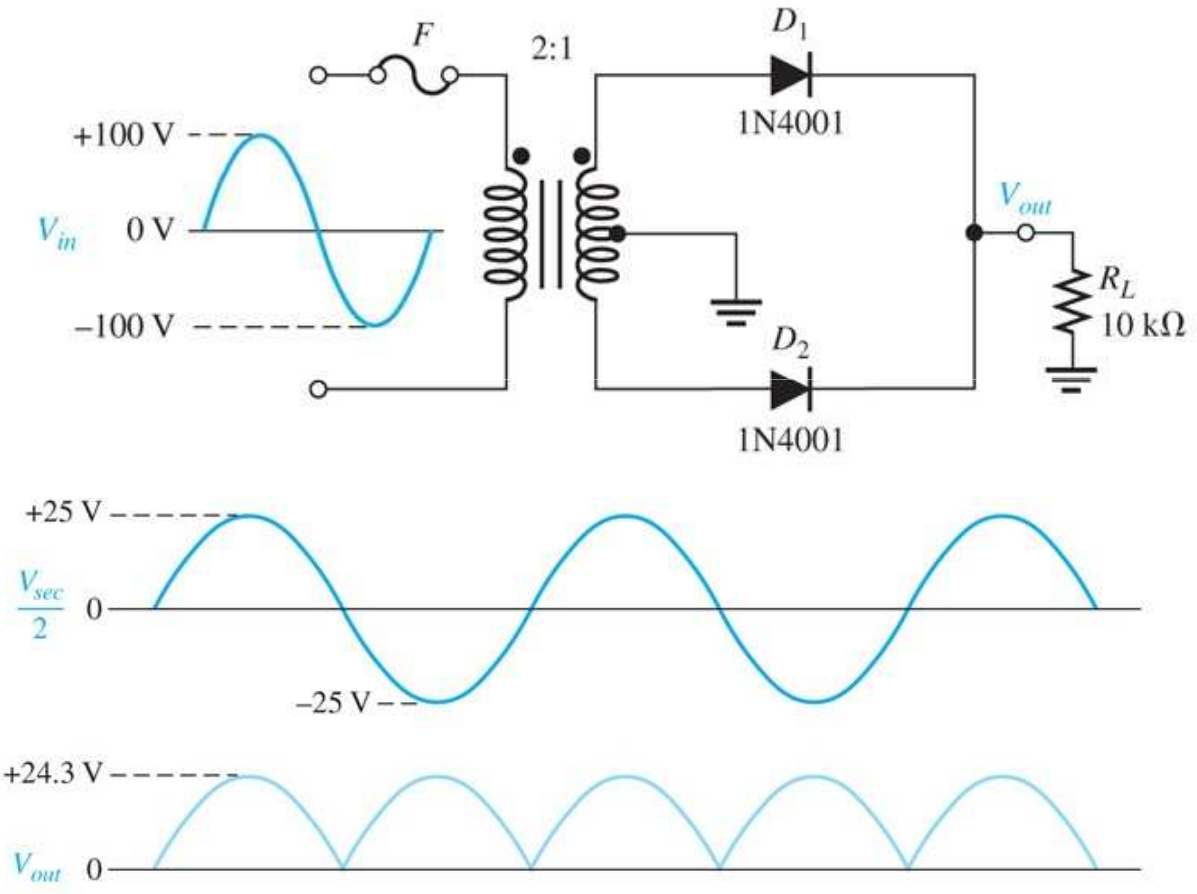


Diode Applications



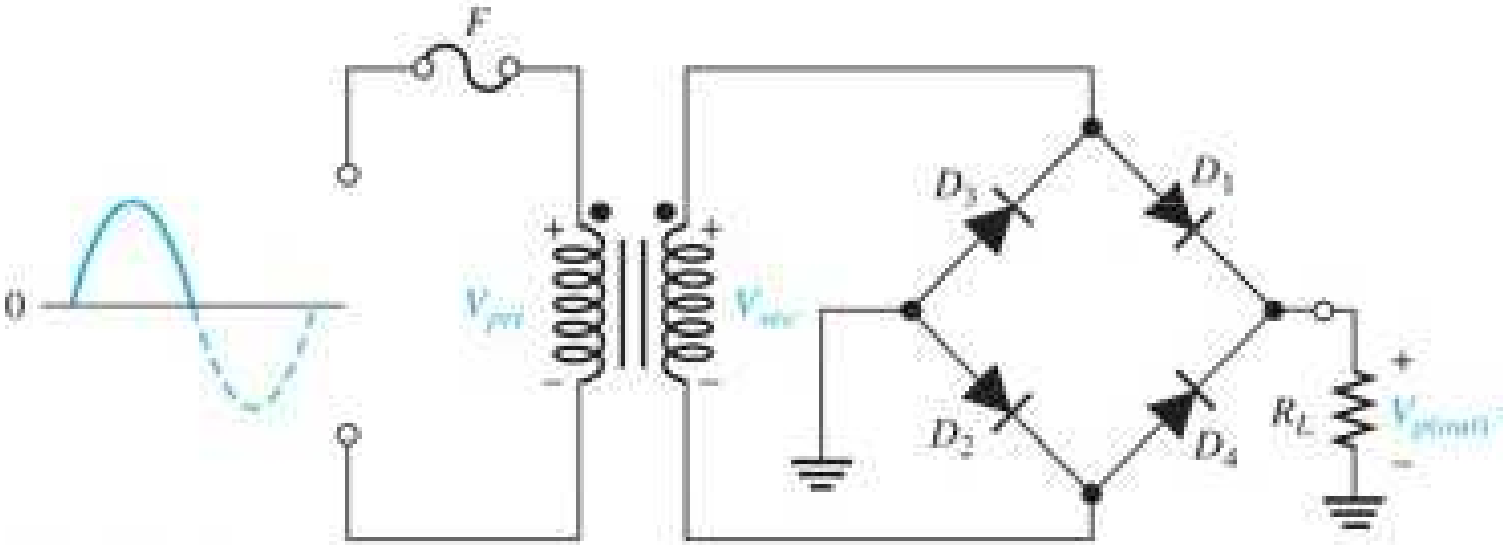
$PIV =$

Diode Applications

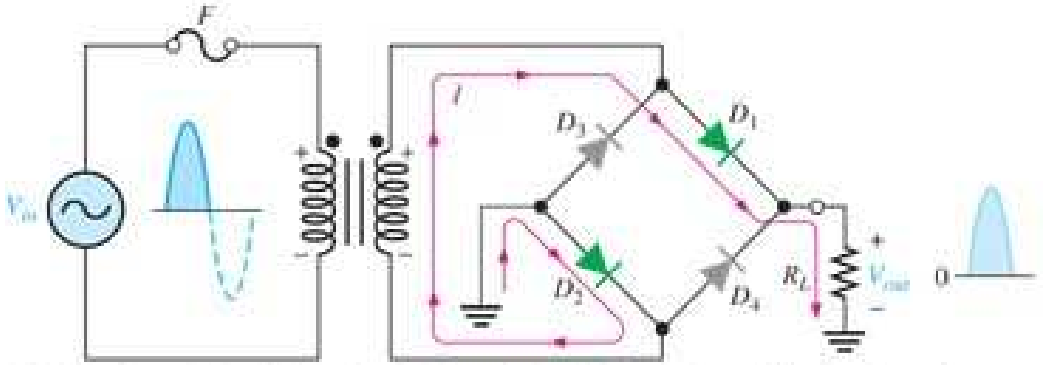


Diode Applications

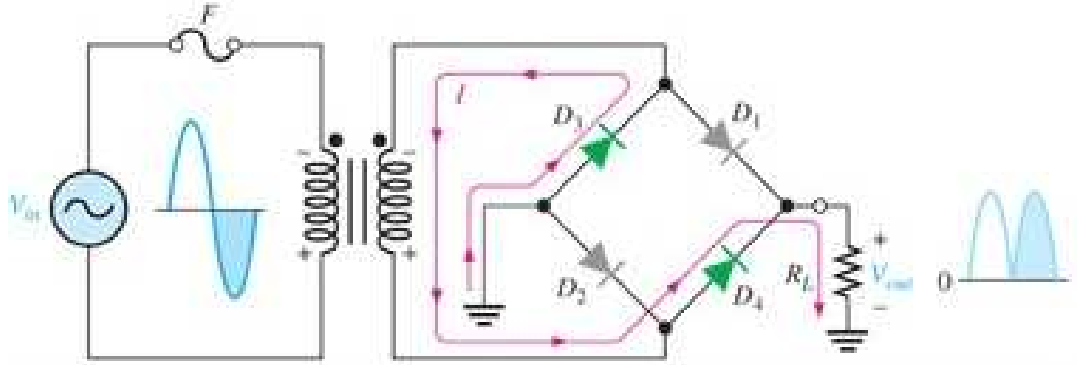
- مقوم الموجة الكاملة باستخدام جسر من الديودات:



Diode Applications

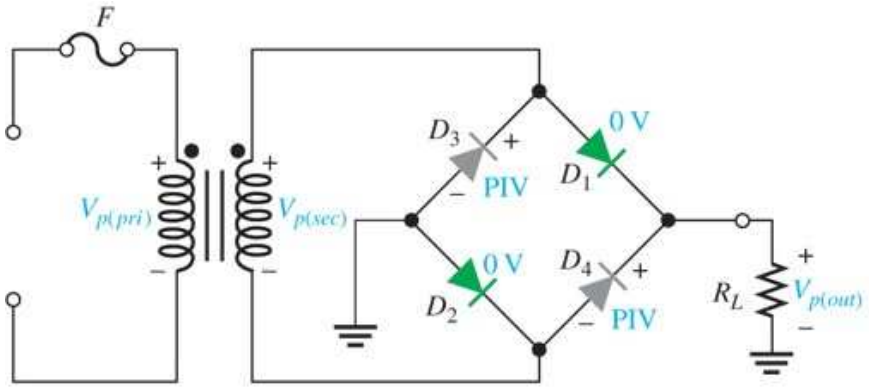


(a) During the positive half-cycle of the input, D_1 and D_2 are forward-biased and conduct current. D_3 and D_4 are reverse-biased.

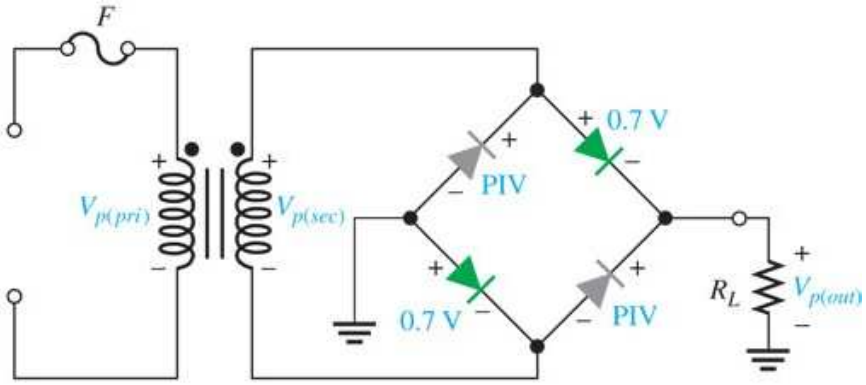


(b) During the negative half-cycle of the input, D_3 and D_4 are forward-biased and conduct current. D_1 and D_2 are reverse-biased.

Diode Applications



(a) For the ideal diode model (forward-biased diodes D_1 and D_2 are shown in green), PIV = $V_{p(out)}$.



(b) For the practical diode model (forward-biased diodes D_1 and D_2 are shown in green), PIV = $V_{p(out)}$ + 0.7 V.

Diode Applications

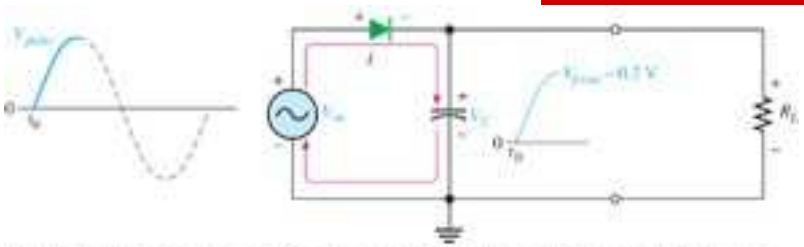
تنظيم الجهد

هو تحويل الموجة المقومة النبضية المستمرة إلى جهد مستمر أكثر نعومة ويستخدم من لتحقيق ذلك مرشح سعوي (مكثف) مناسب

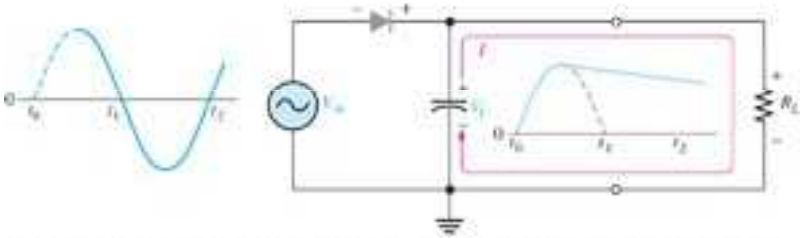
(a) Rectifier without a filter

(b) Rectifier with a filter (output ripple is exaggerated)

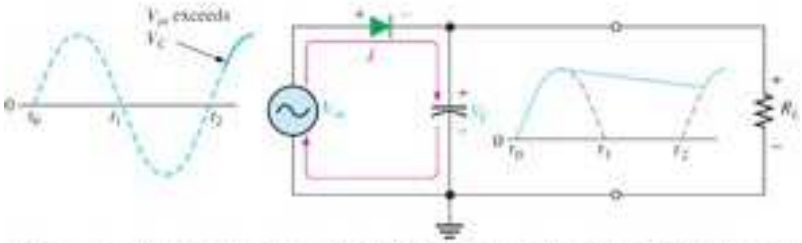
Diode Applications



(a) Initial charging of the capacitor (diode is forward-biased) happens only once when power is turned on.

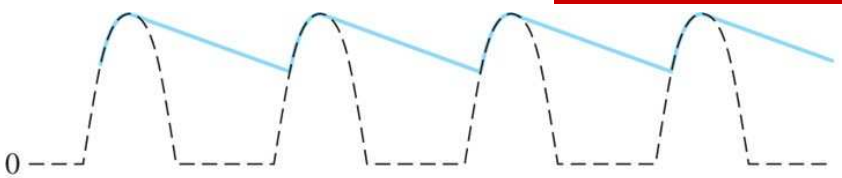


(b) The capacitor discharges through R_L after peak of positive alternation when the diode is reverse-biased. This discharging occurs during the portion of the input voltage indicated by the solid dark blue curve.

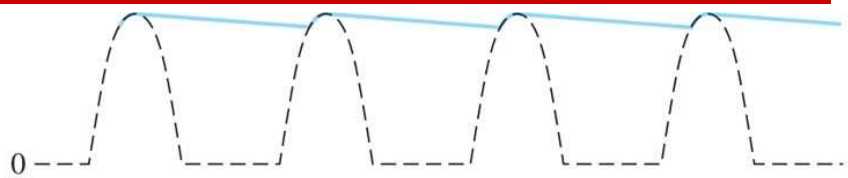


(c) The capacitor charges back to peak of input when the diode becomes forward-biased. This charging occurs during the portion of the input voltage indicated by the solid dark blue curve.

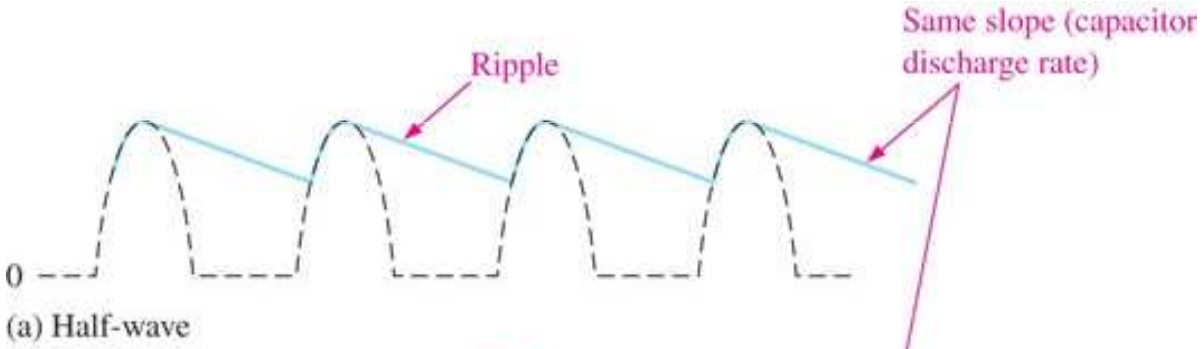
Diode Applications



(a) Larger ripple means less effective filtering.

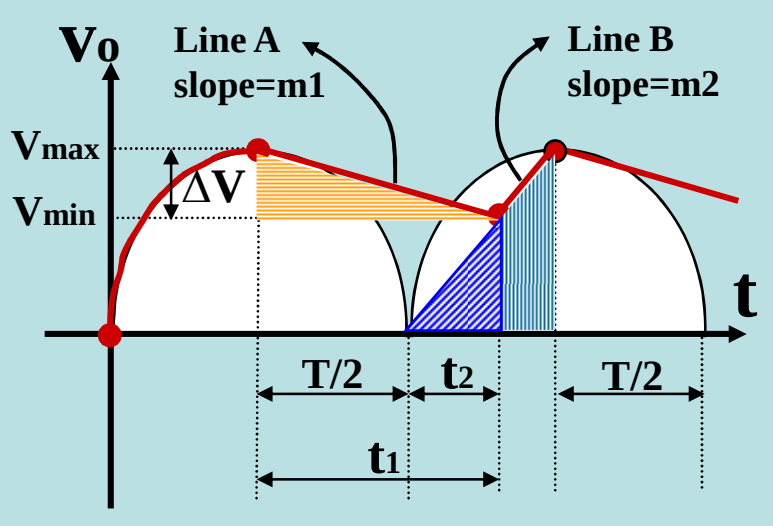


(b) Smaller ripple means more effective filtering. Generally, the larger the capacitor value, the smaller the ripple for the same input and load.



Diode Applications

حساب قيمة المكثف اللازم لحمل معين للحصول على قيمة تعرج مرغوبة باستخدام تقريب الخط المستقيم



$$\Delta V = V_{max} - V_{min}$$

$$m_1 = \frac{-V_{max}}{R_L.C}$$

يفرغ المكثف شحنته وفق الخط المستقيم A ذو الميل m1:

$$m_2 = \frac{V_{max}}{T/2}$$

يُشحن المكثف وفق الخط المستقيم B ذو الميل m2:

$$t_1 = \frac{-\Delta V}{m_1} = \frac{R_L.C.\Delta V}{V_{max}}$$

$$t_2 = \frac{V_{min}}{m_2} = \frac{T.V_{min}}{2V_{max}}$$

$$t_1 = \frac{T}{2} + t_2 = \frac{T}{2} + \frac{T.V_{min}}{2V_{max}} = \frac{R_L.C.\Delta V}{V_{max}} = \frac{T(2 - \Delta V/V_{max})}{2}$$

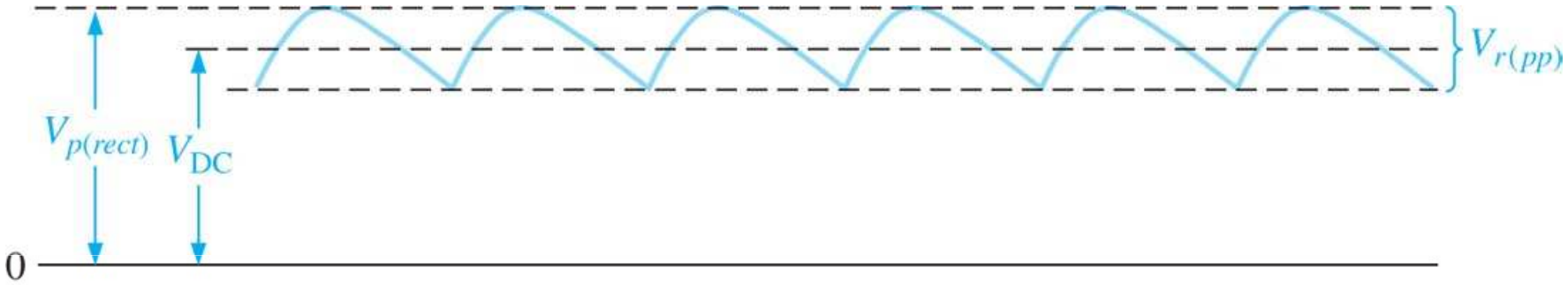
$$R_L.C.\frac{\Delta V}{V_{max}} = \frac{1}{2F_P}(2 - \frac{\Delta V}{V_{max}}) = \frac{1}{F_P}(1 - \frac{\Delta V}{2V_{max}})$$

$$\frac{\Delta V}{2V_{max}} << 1 \Rightarrow R_L.C.\frac{\Delta V}{V_{max}} = \frac{1}{F_P}$$

$$C = \frac{V_{max}}{\Delta V.F_P.R_L}$$

Diode Applications

حساب قيمة التعرج لمكثف ومقاومة حمل معلومين:



$$r = \frac{V_{r(PP)}}{V_{DC}}$$

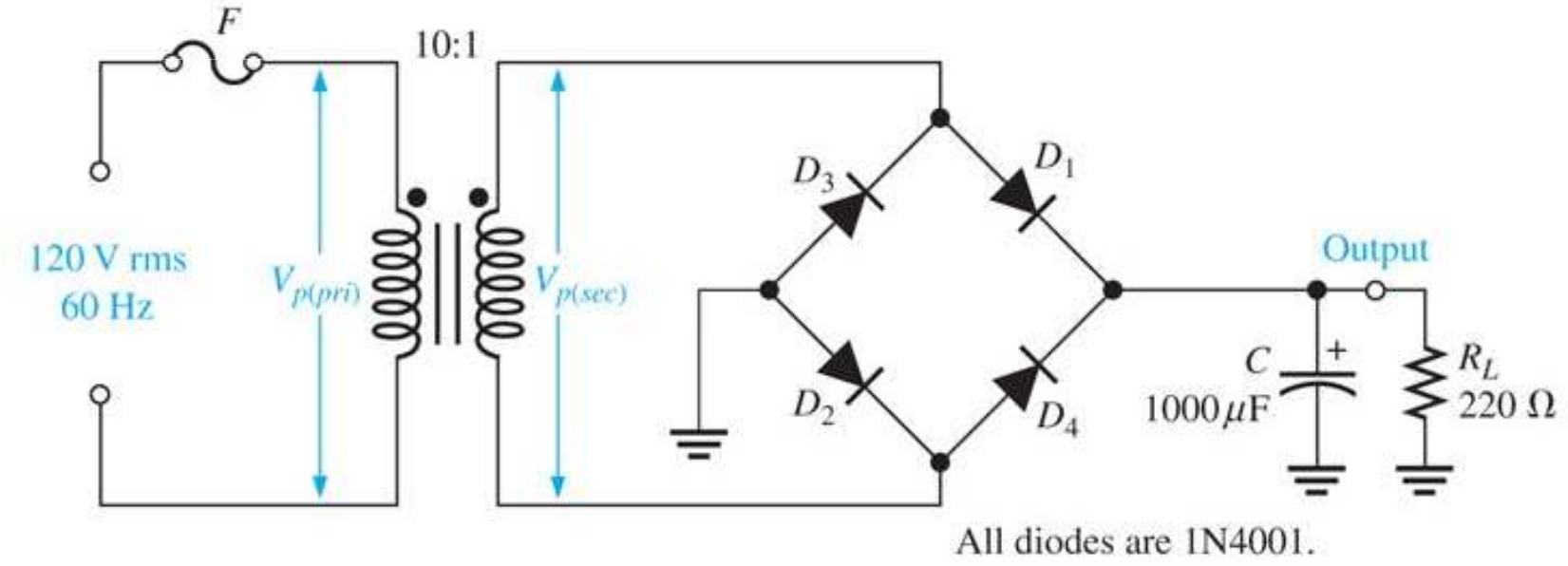
$$V_{r(PP)} = \frac{1}{f.R_L.C} V_{P(rect)}$$

$$V_{DC} = \left(1 - \frac{1}{2f.R_L.C}\right) V_{P(rect)}$$

Diode Applications

مثال:

في الدارة المبينة أدناه المطلوب:
1) رسم إشارة الخرج (حساب المطال ودور الإشارة)
2) حساب عامل التعرج



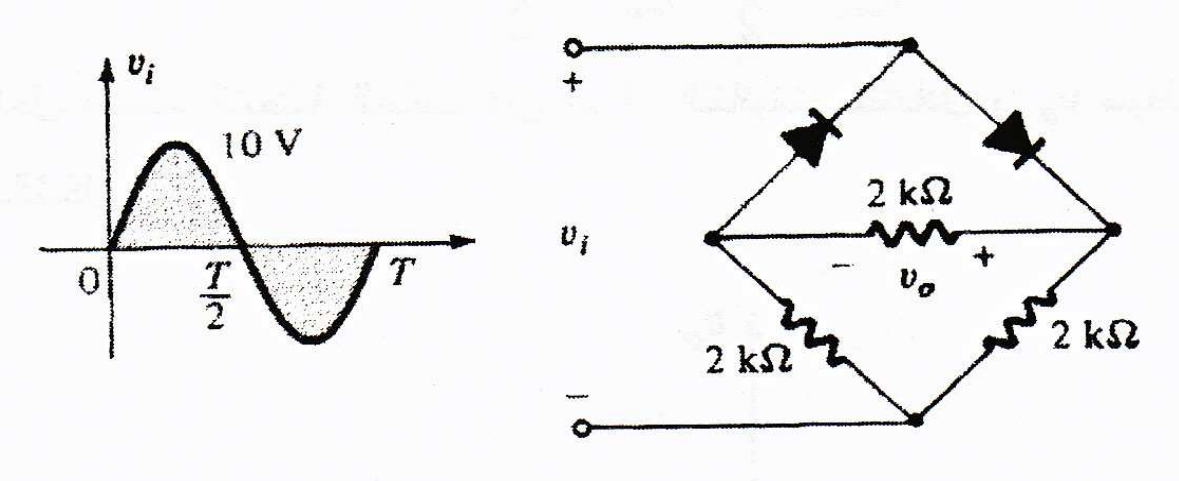
Diode Applications

Diode Applications

السؤال الثاني: /10/ درجات تكميلية 2013/2014

في الدارة المبينة بالشكل أدناه وبفرض أنَّ الثنائيات مثالية، المطلوب:

1. احسب ثم ارسم شكل إشارة V_o.....**(2+5) درجة**
2. احسب جهد القمة العكسي PIV.....**(3) درجة**



Diode Applications

Diode Applications

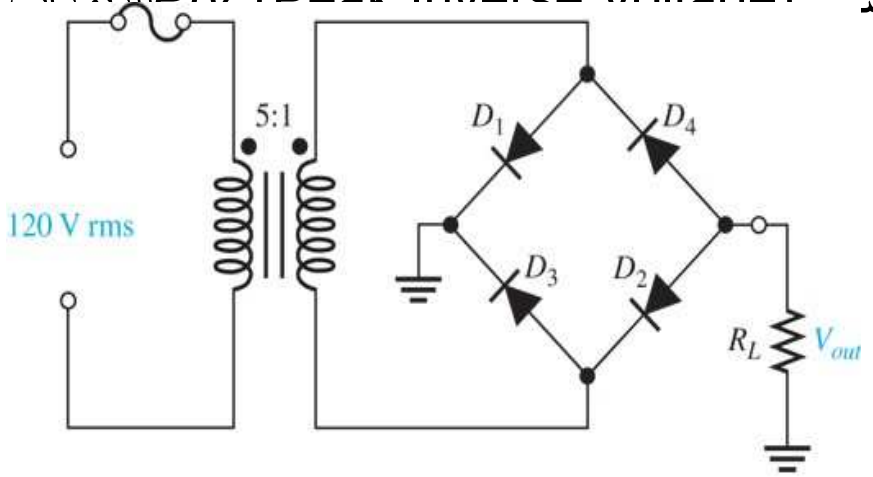
السؤال الأول: /12/ درجات فصل ثاني 2014/2015

في الدارة المبينة أدناه المطلوب:

1) ارسم وبشكل واضح شكل إشارة الخرج V_{out}، (مبيناً مطال ودور الإشارة) مستخدماً النموذج العملي للديود، علماً أنَّ R_L = 220 Ω.....**(6) درجة**

2) أضف إلى خرج الدارة وعلى التفرع مع R_L مكثفة قيمته 1000 µF، احسب قيمة عامل التعــرج.**(3) درجة**

3) حدد جهد القمة العكسي PIV (Peak Inverse Voltage) للديودات المُستخدَمة.....**(3) درجة**

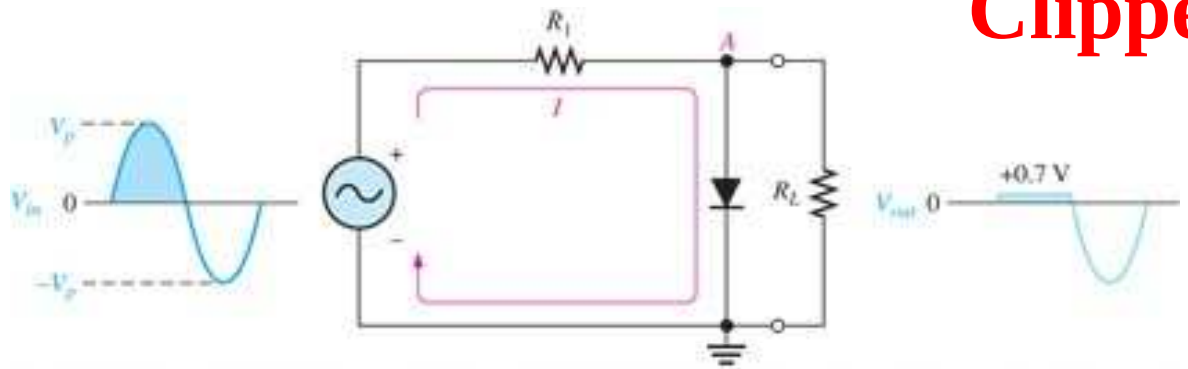


Diode Applications

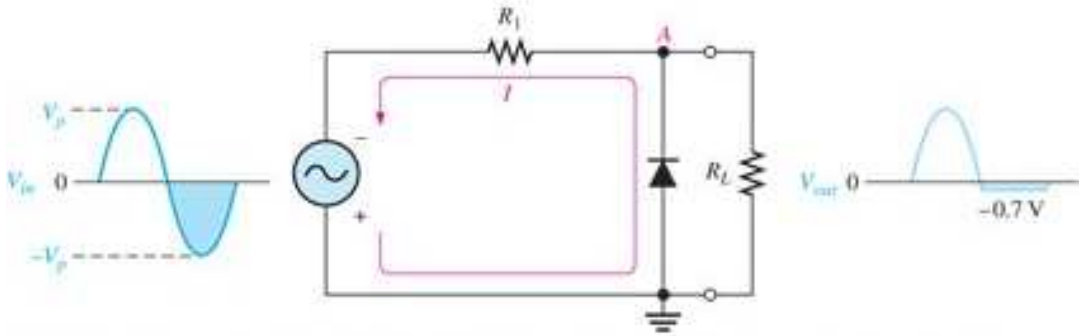
Diode Applications

3. دارات القص: Clippers

وهي دارات نستطيع من خلالها الحصول على جزء مرغوب من إشارة الدخل المتناوبة

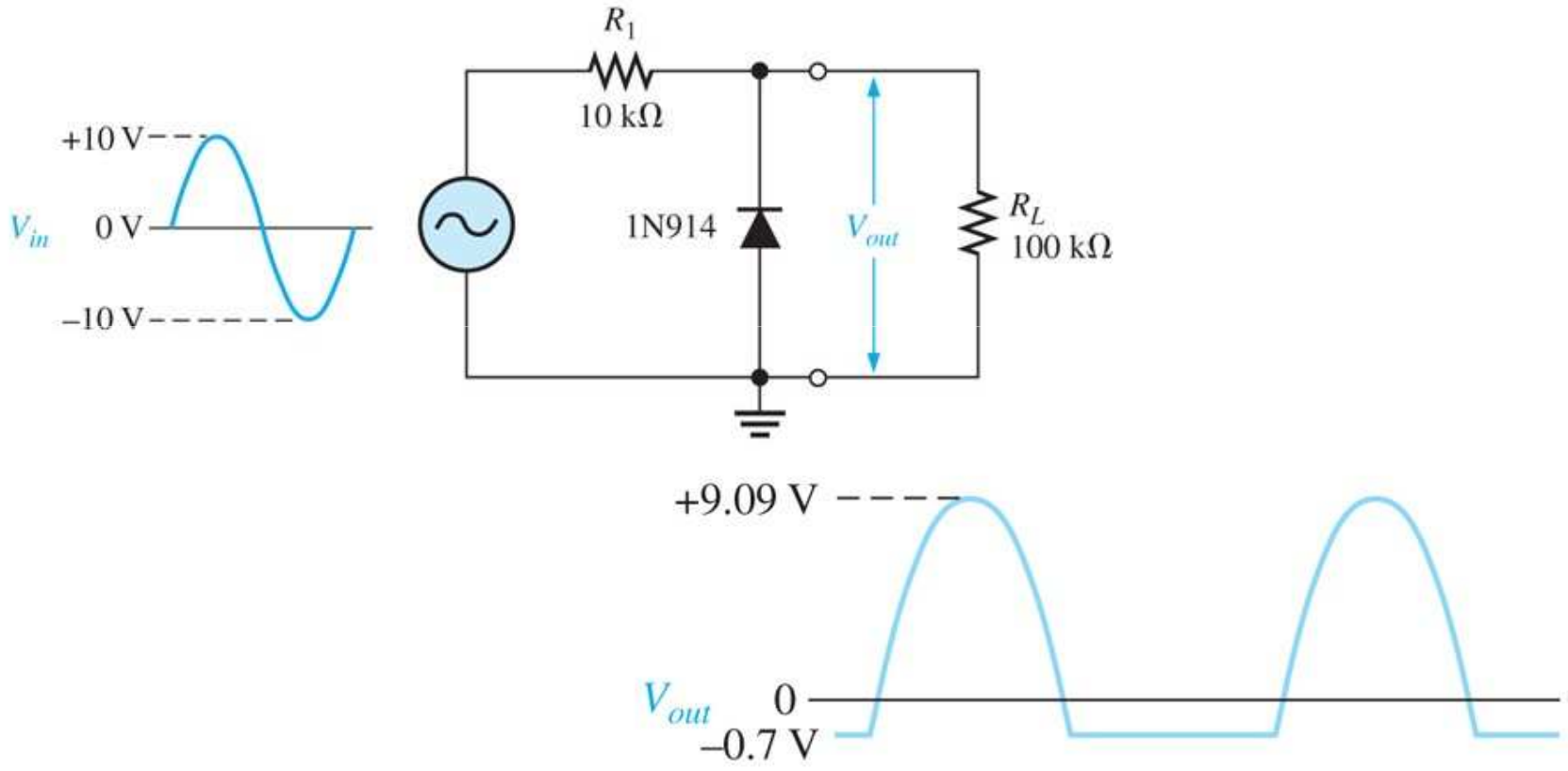


(a) Limiting of the positive alternation. The diode is forward-biased during the positive alternation (above 0.7 V) and reverse-biased during the negative alternation.

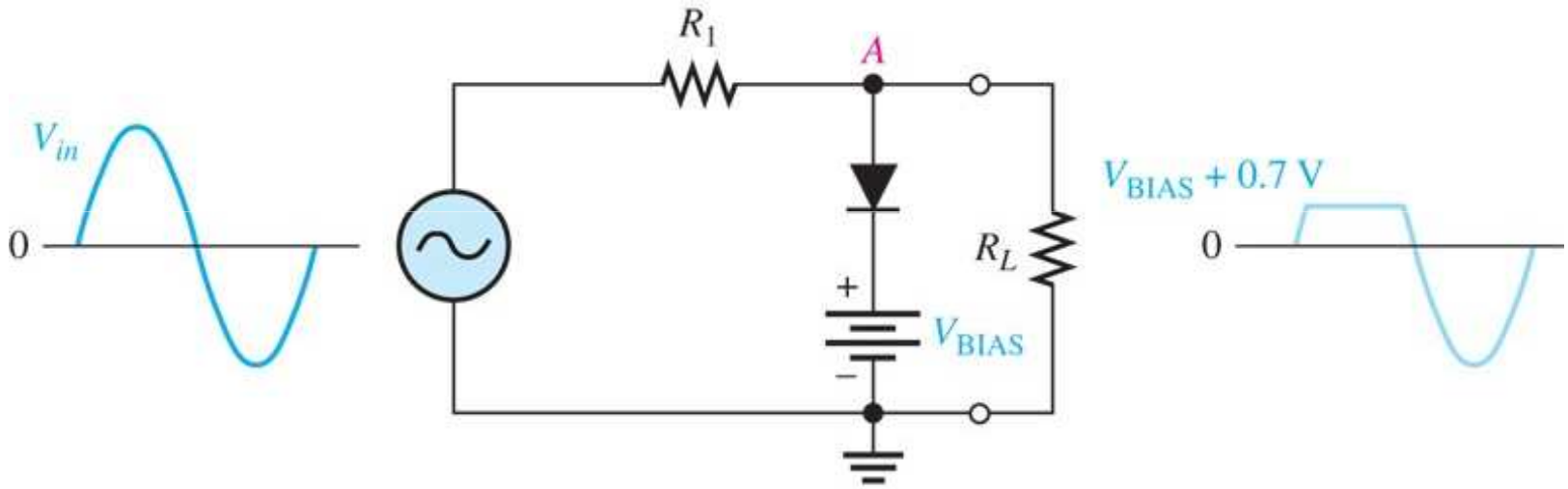


(b) Limiting of the negative alternation. The diode is forward-biased during the negative alternation (below −0.7 V) and reverse-biased during the positive alternation.

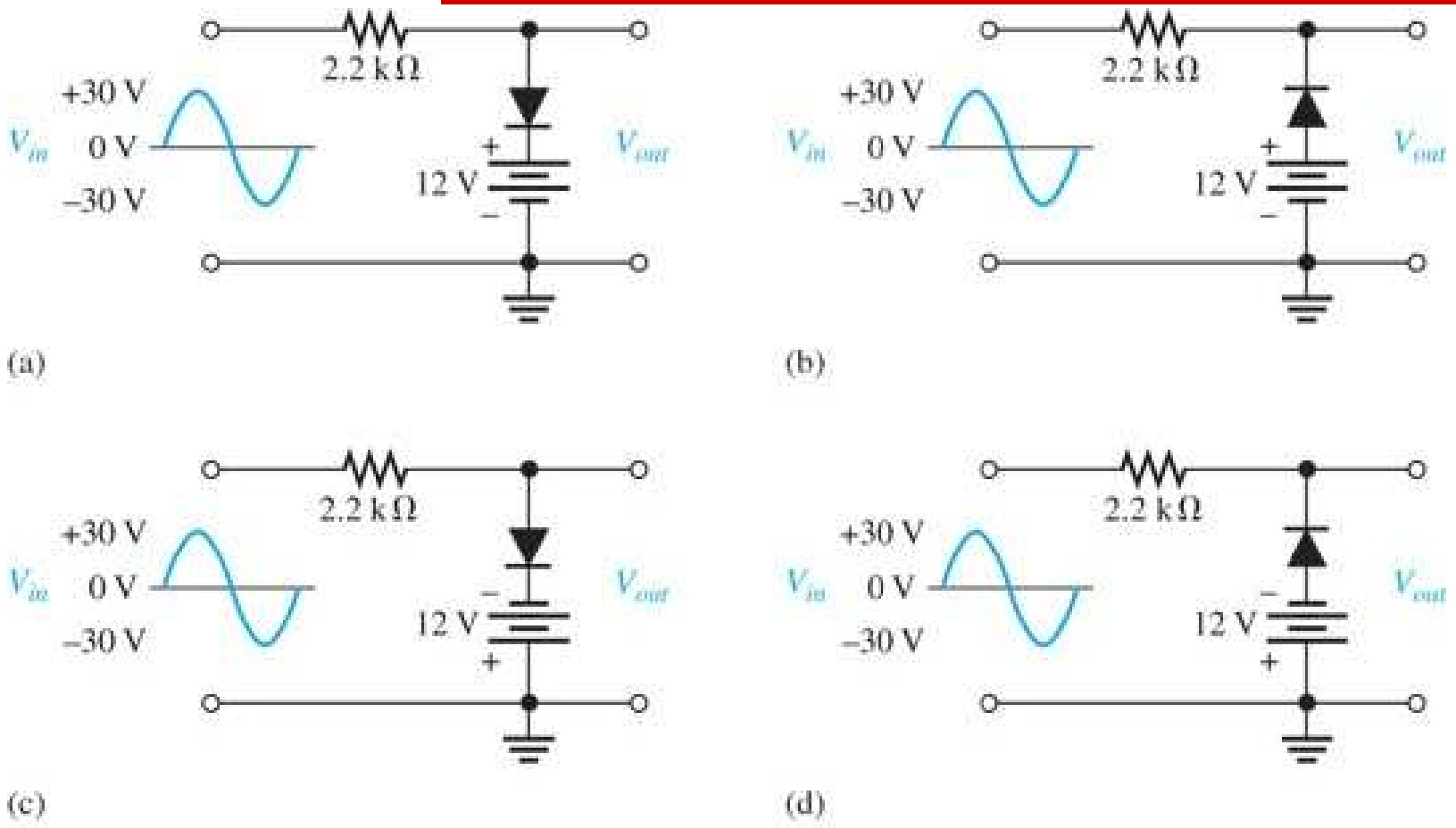
Diode Applications



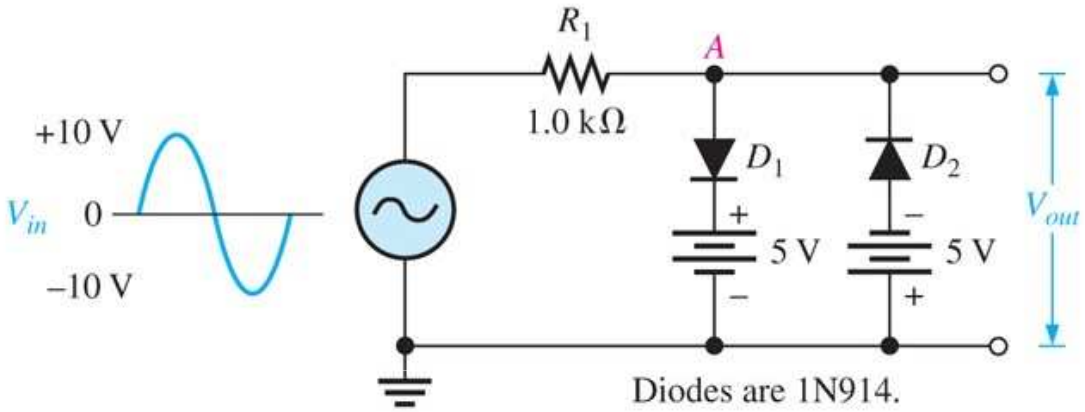
Diode Applications

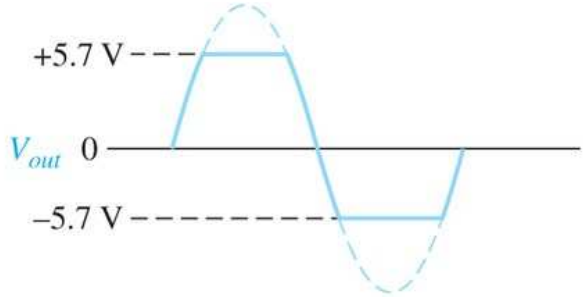


Diode Applications

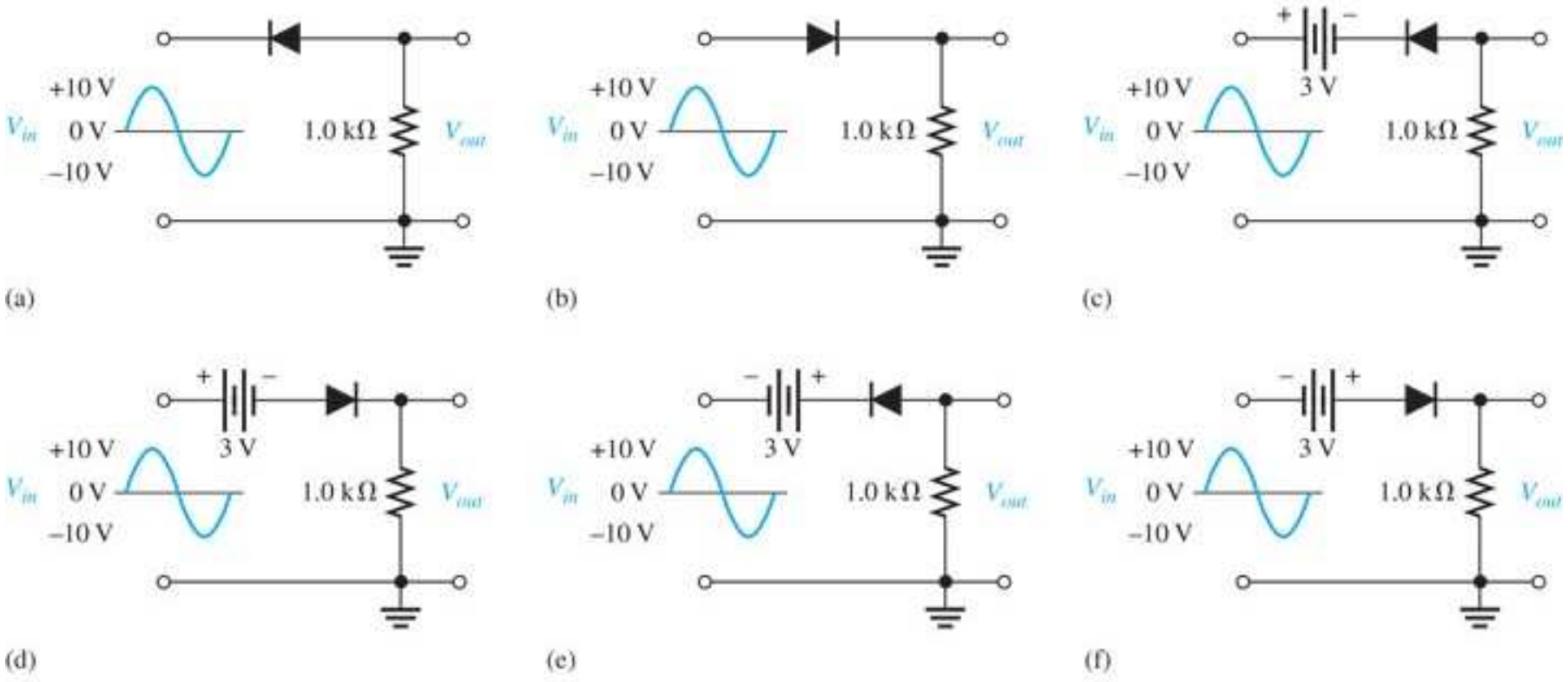


Diode Applications





Diode Applications



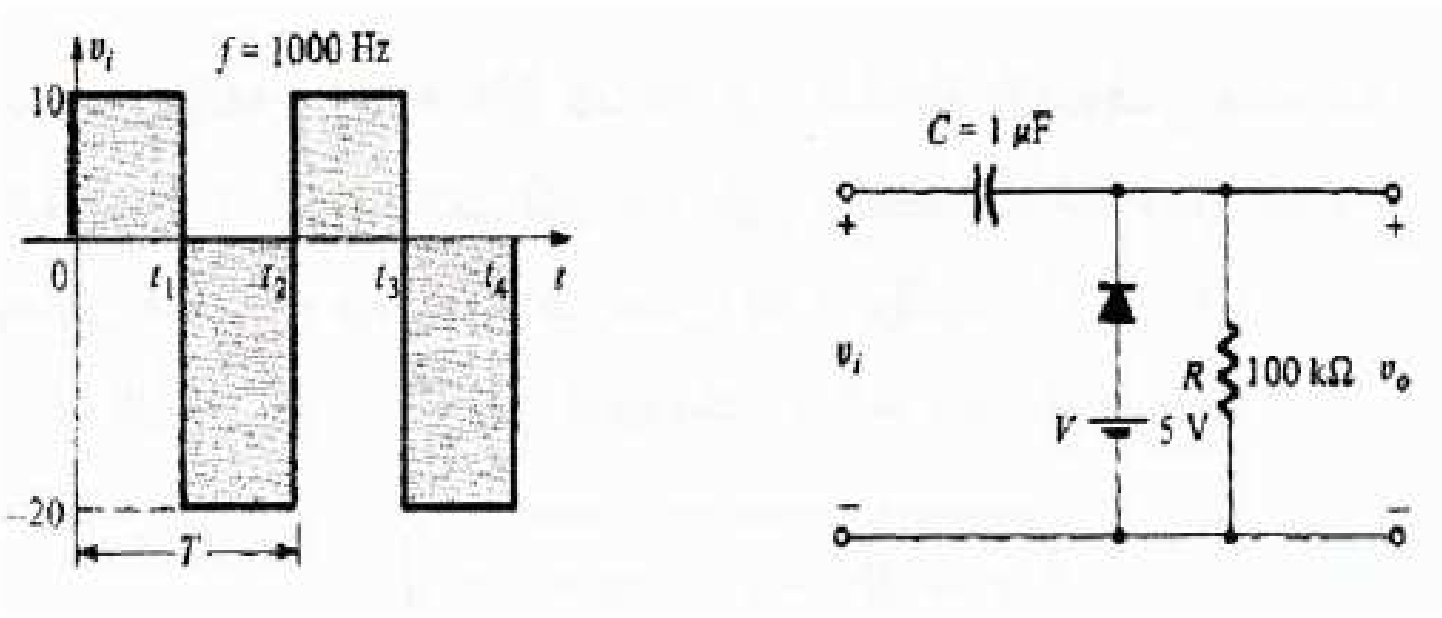
Diode Applications

3. دارات الإزاحة: Clampers

Diode Applications

مثال:

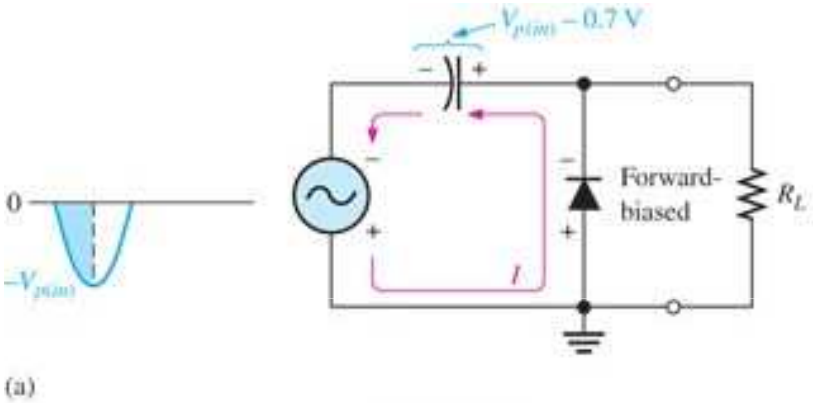
في الدارة المبينة أدناه المطلوب: ناقش ثم ارسم إشارة الخرج



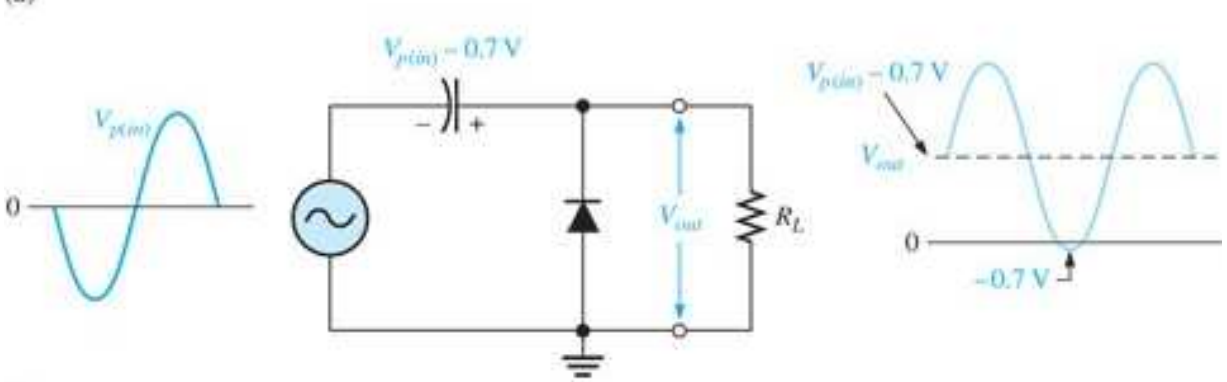
Diode Applications

3. دارات الإزاحة: Clampers

وهي دارات نستطيع من خلالها إزاحة إشارة الدخل المتناوبة بمقدار مرغوب.

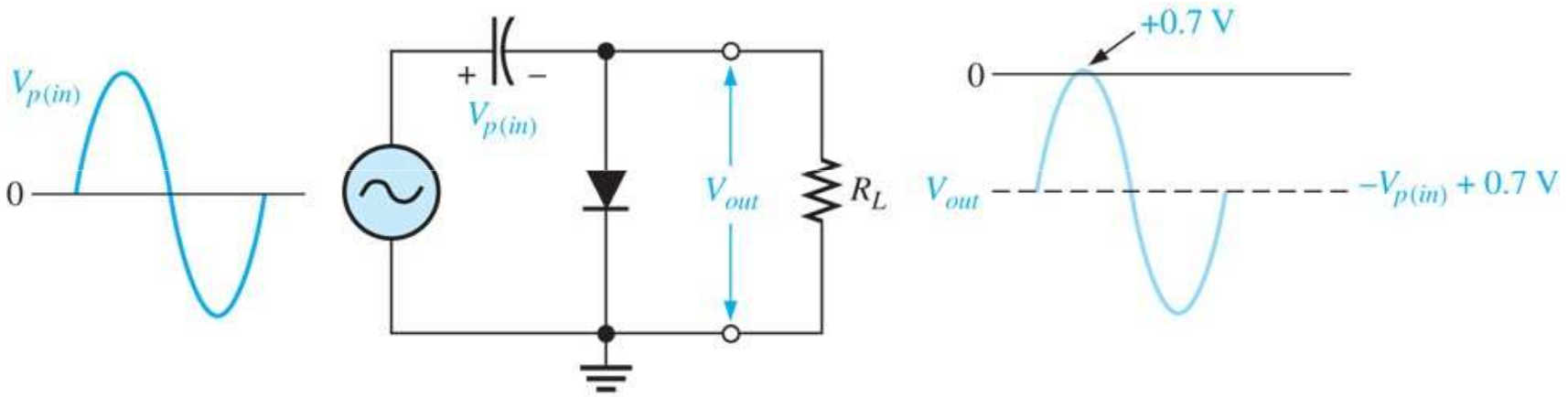


(a)



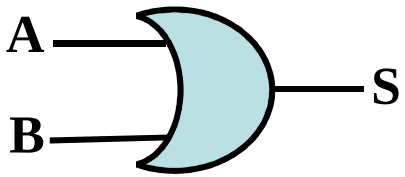
(b)

Diode Applications



Diode Applications

3. دارات التبديل باستخدام الديودات:



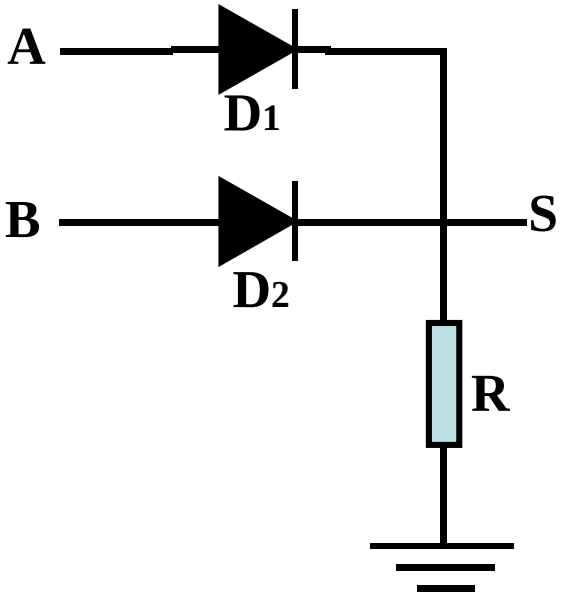
الرمز الكهربائي

$$S = A \oplus B$$

المعادلة الرياضية

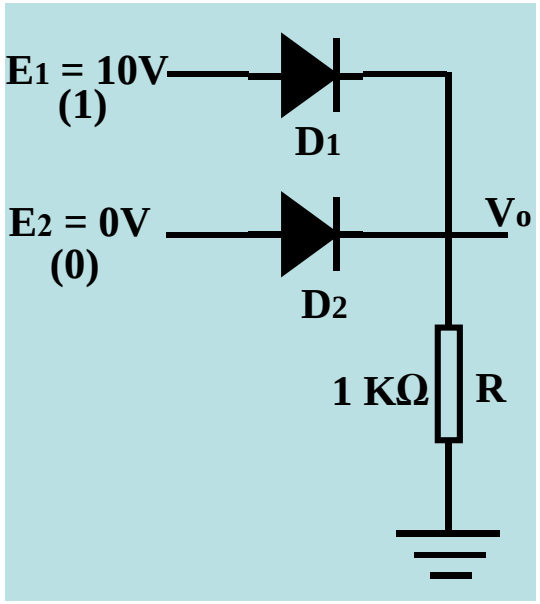
A	B	S
0	0	0
0	1	1
1	0	1
1	1	1

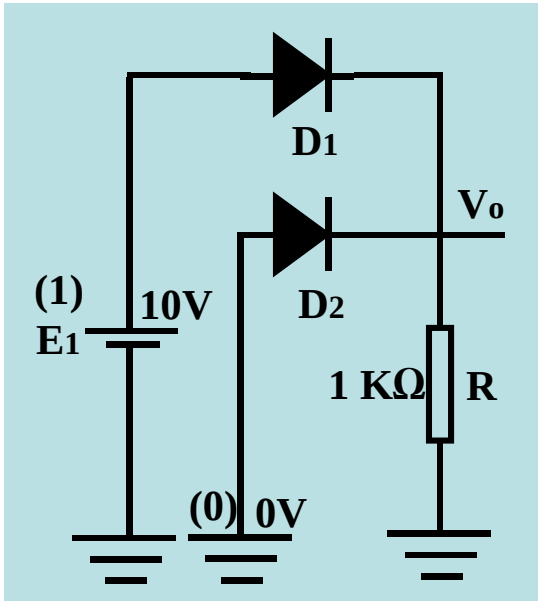
جدول الحقيقة

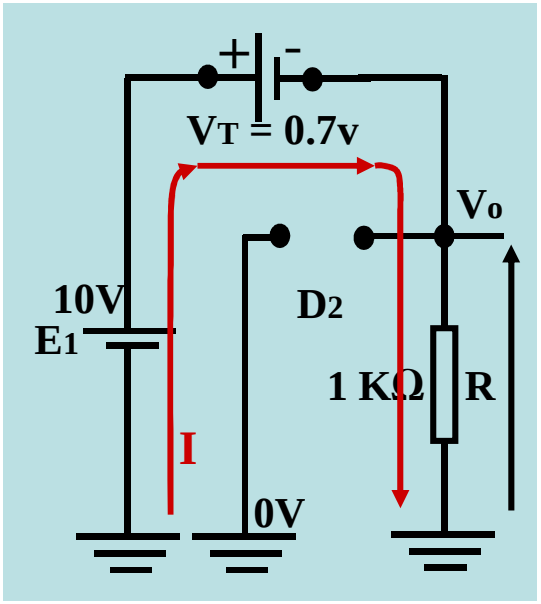


Diode Applications

مثال: حدد الجهد Vo للدارة التالية علماً أن $V_T = 0.7V$:

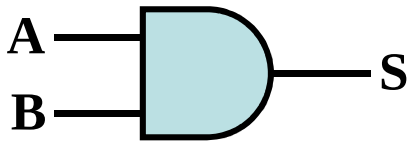






$$V_O = E_1 - V_D = 10 - 0.7 = 9.3 \text{ V} \qquad I = \frac{E_1 - V_D}{R} = \frac{10 - 0.7}{1K\Omega} = 9.3mA$$

Diode Applications



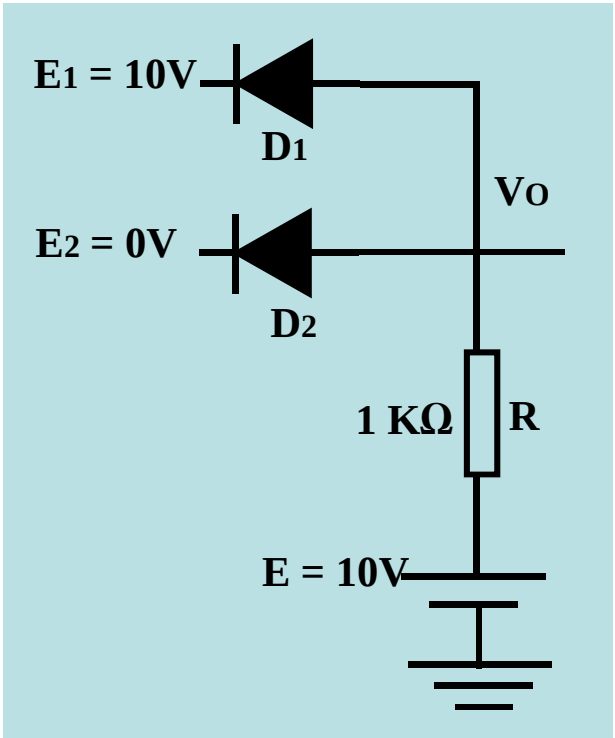
الرمز الكهربائي

$$S = A \otimes B$$

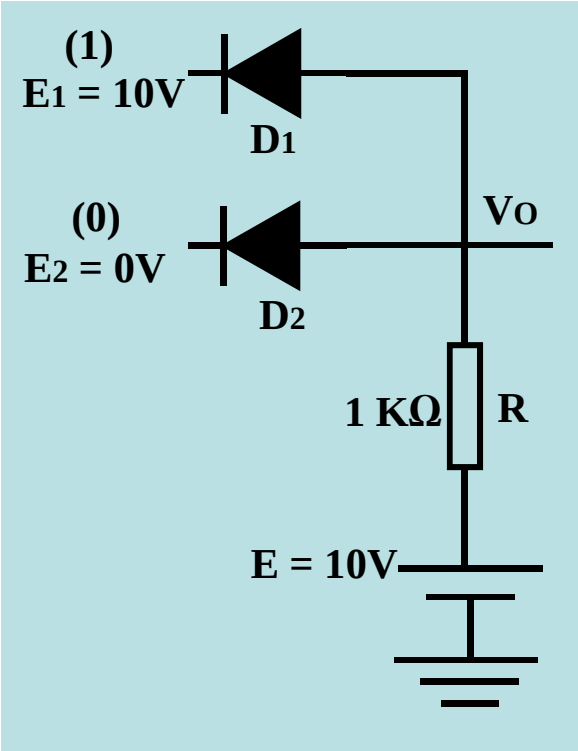
المعادلة الرياضية

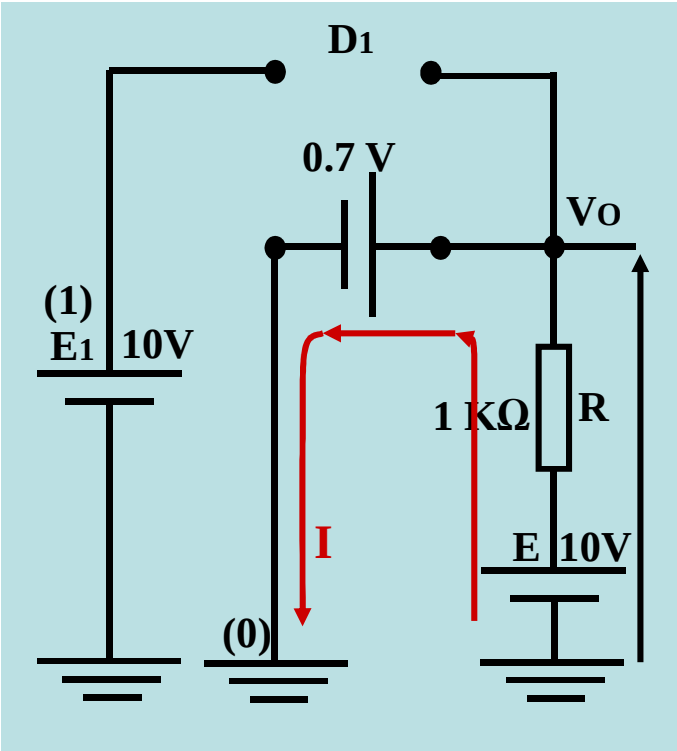
A	B	S
0	0	0
0	1	0
1	0	0
1	1	1

جدول الحقيقة



Diode Applications





$$V_O = V_T = 0.7V$$

$$I = \frac{E - V_D}{R}$$

$$= \frac{10 - 0.7}{1K\Omega} = 9.3mA$$

ERROR: undefined
OFFENDING COMMAND: Diode

STACK:

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/ModDate
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/Keywords
(PDFCreator Version 0.9.5)
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