Electronic Devices and Circuits

EME306

(Summer 2021-2022)

Lecture 3

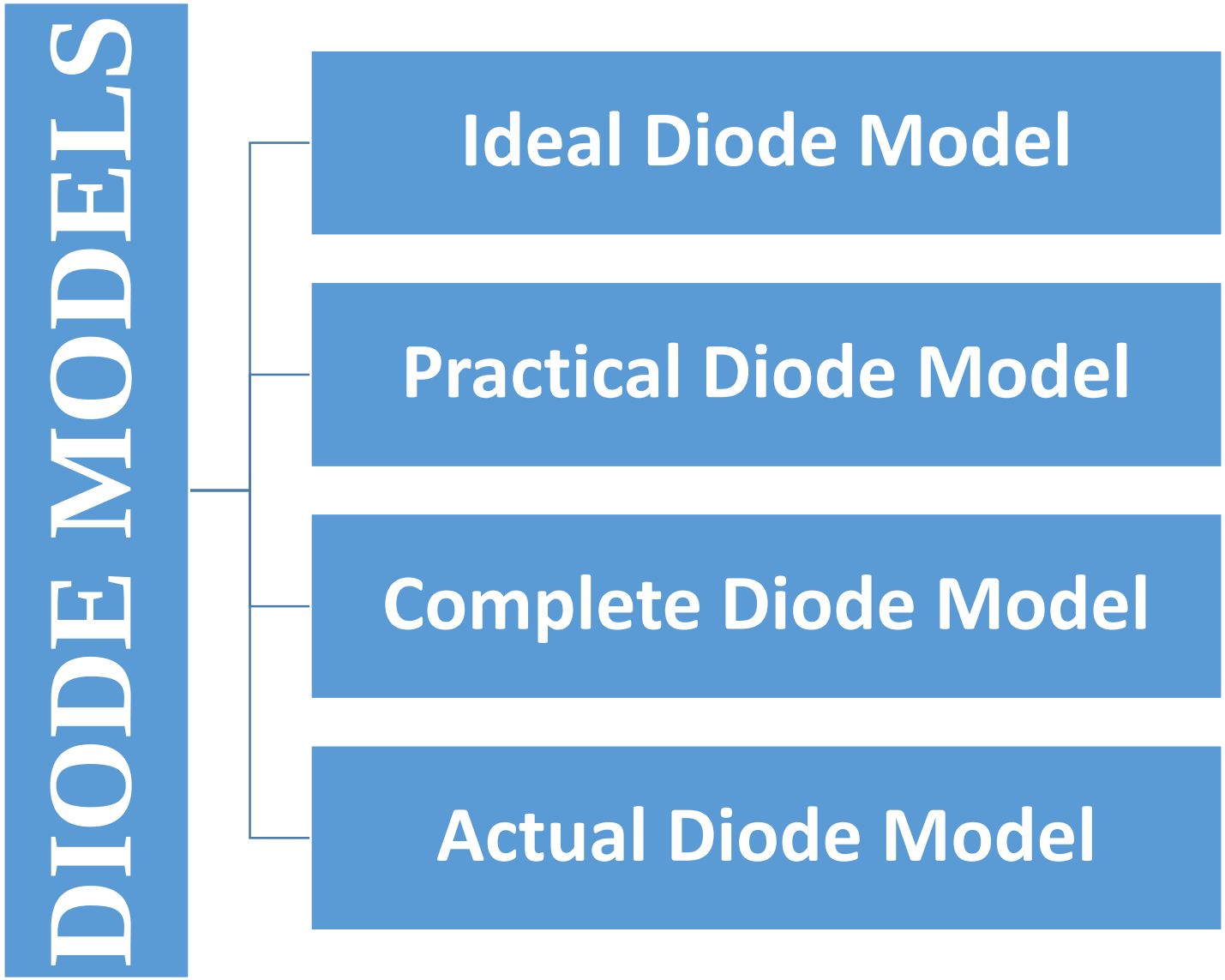
DIODE MODELS

INSTRUCTOR

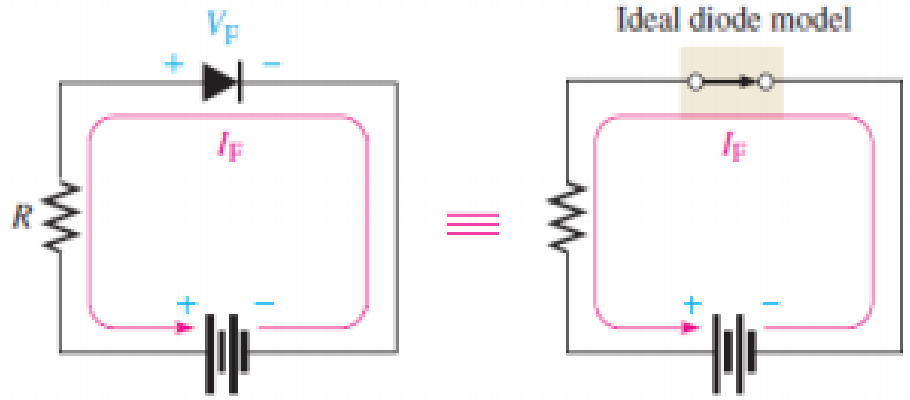
Dr / Ayman Soliman

Contents

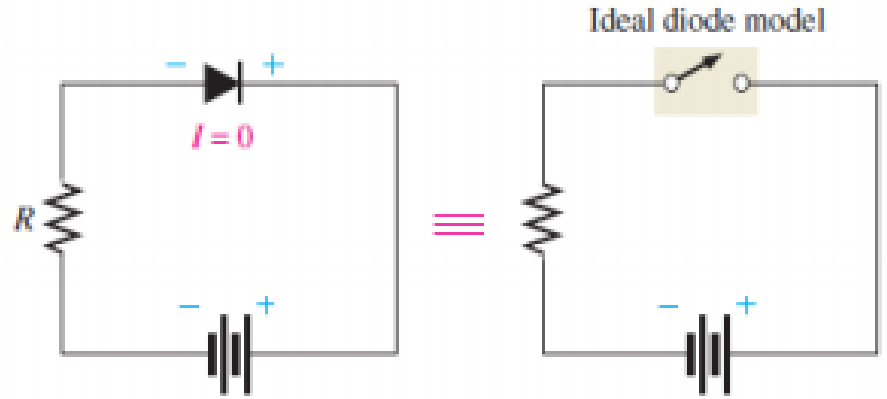
1) DIODE MODELS
2) The Ideal Diode Model
3) The Practical Diode Model
4) The Complete Diode Model
5) The Actual Diode Model
6) Diodes circuits
7) examples


DIODE MODELS
Ideal Diode Model
Practical Diode Model
Complete Diode Model
Actual Diode Model

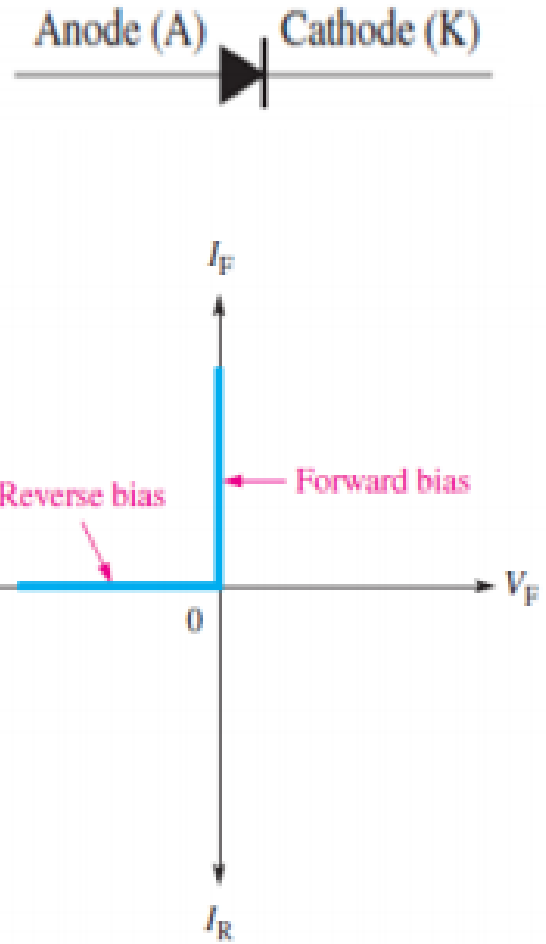
The Ideal Diode Model



(a) Forward bias

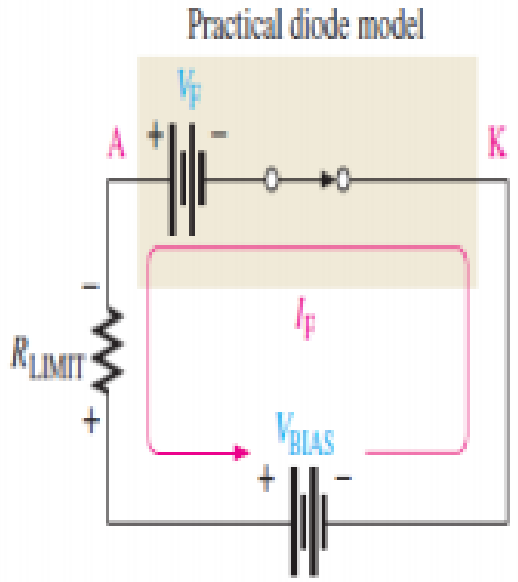


(b) Reverse bias

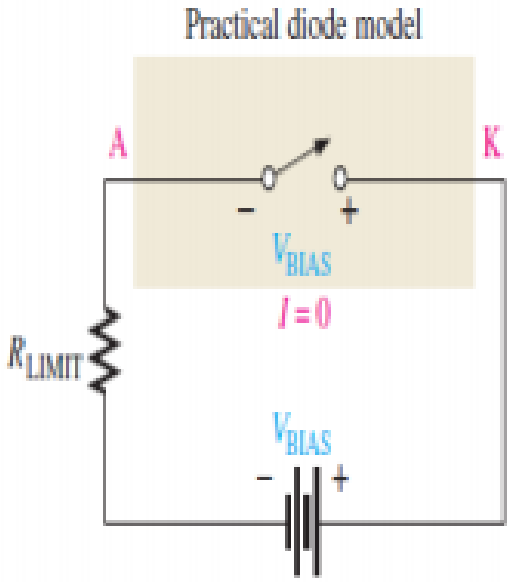


(c) Ideal *V-I* characteristic curve (blue)

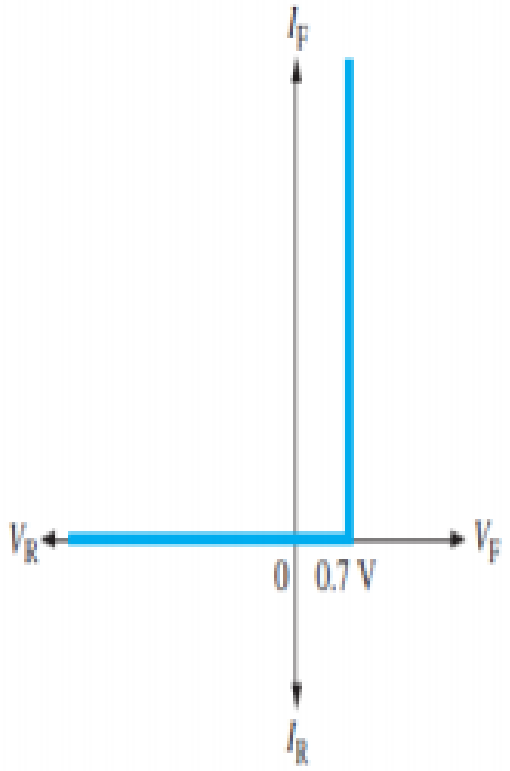
The Practical Diode Model



(a) Forward bias

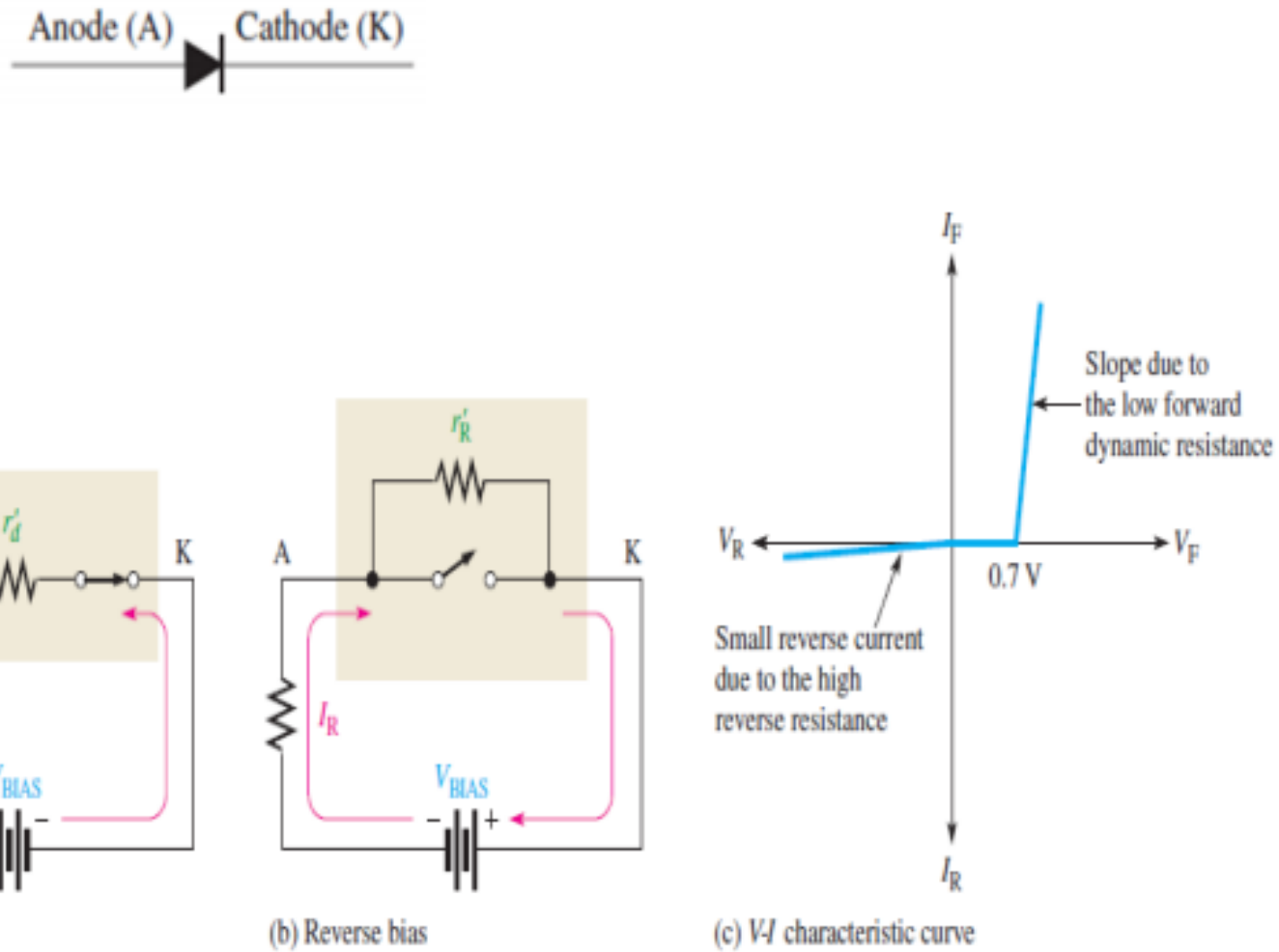


(b) Reverse bias



(c) Characteristic curve (silicon)

The Complete Diode Model



(a) Forward bias (b) Reverse bias (c) *V-I* characteristic curve

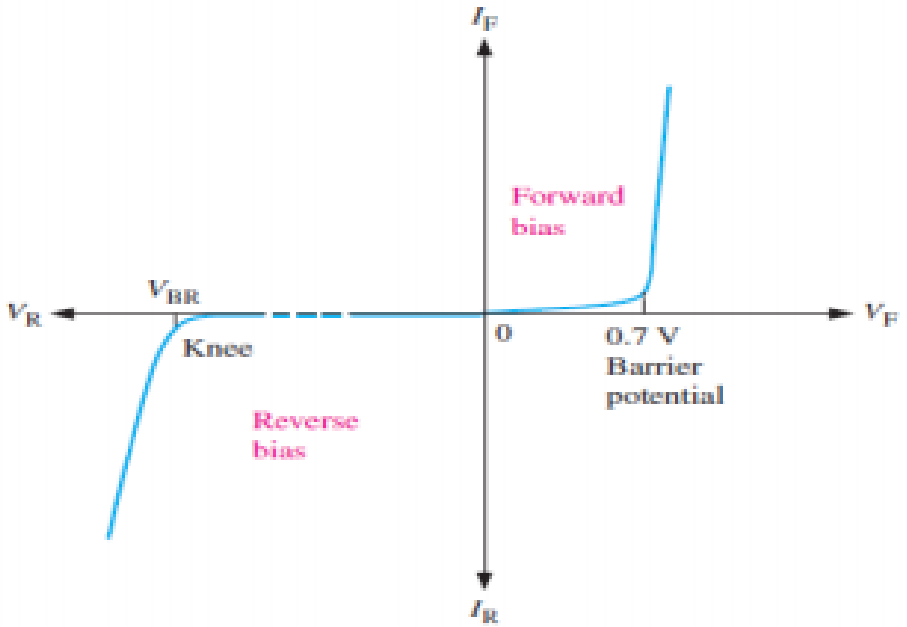
The Actual Diode Model

$$I_D = I_S(e^{\frac{V_D}{nv_t}} - 1)$$

Is scale current

n constant

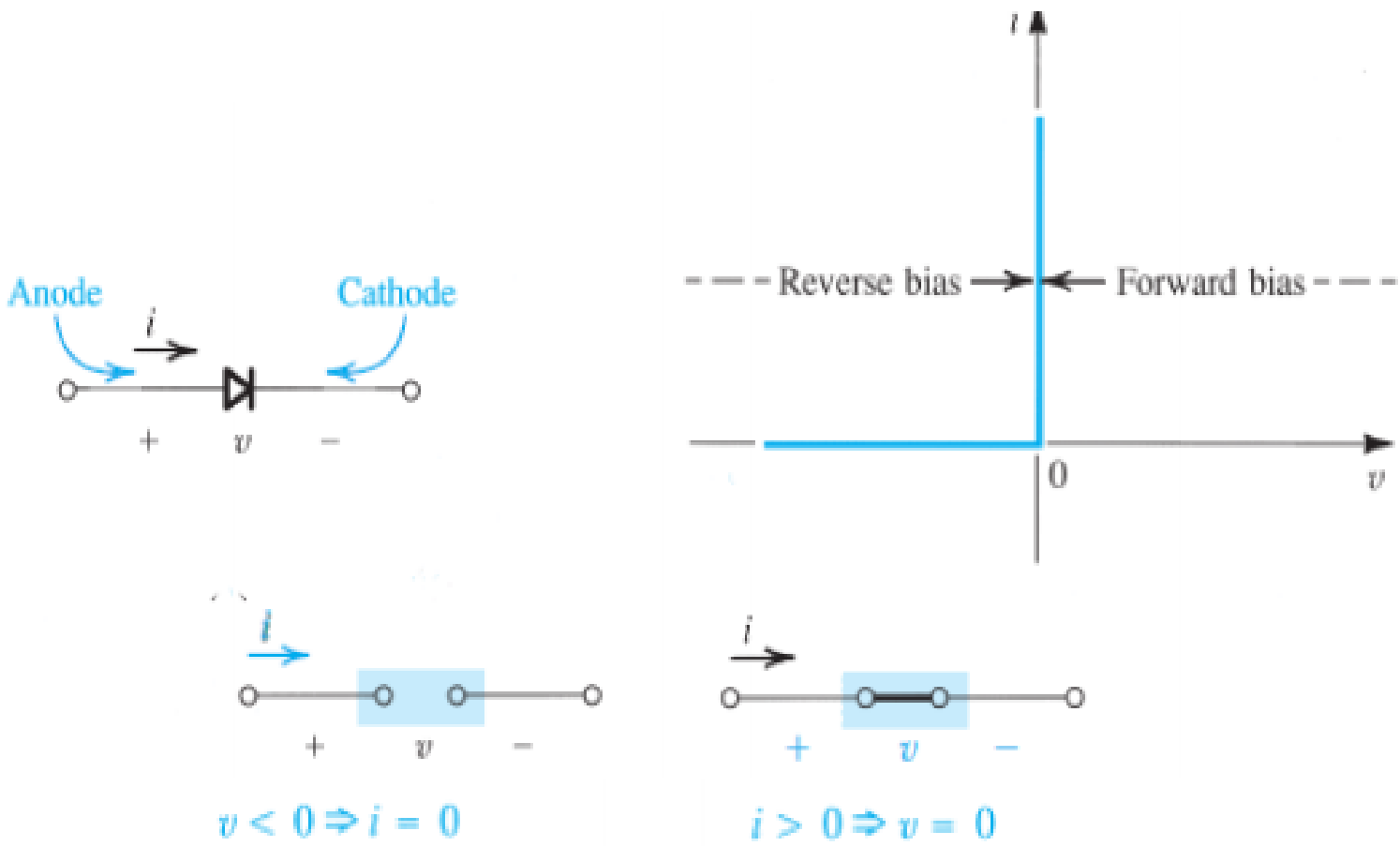
Vt thermal voltage =25mv



The complete *V-I* characteristic curve for a diode.

Diodes circuits

- Ideal diode model



Example

- For the circuit shown, assume ideal diode; find the current in the circuit shown?

For diode in circuit (a)

Diode is on,

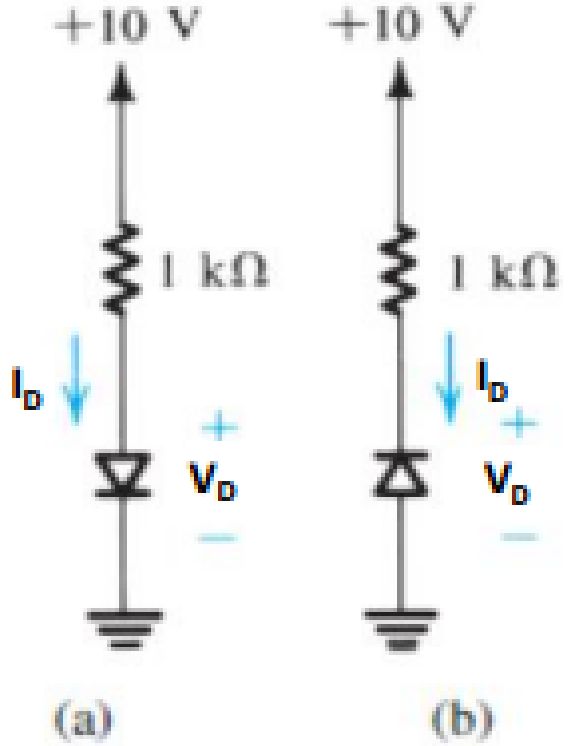
Because diode is ideal diode

V_D=0 v I_D=(10-0)/1KΩ= 10mA

For diode in circuit (b)

Diode is off, so it is open circuit,

and V_D=10 v I_D=0 mA



Example

- Assuming the diodes to be ideal, find the values of I and V in the circuits shown?

For circuit shown in Fig (a)

Assume diode D_1 is on, so V_B=0v

Then diode D_2 will be on

I_{D2}=(10-0)/10 = 1mA

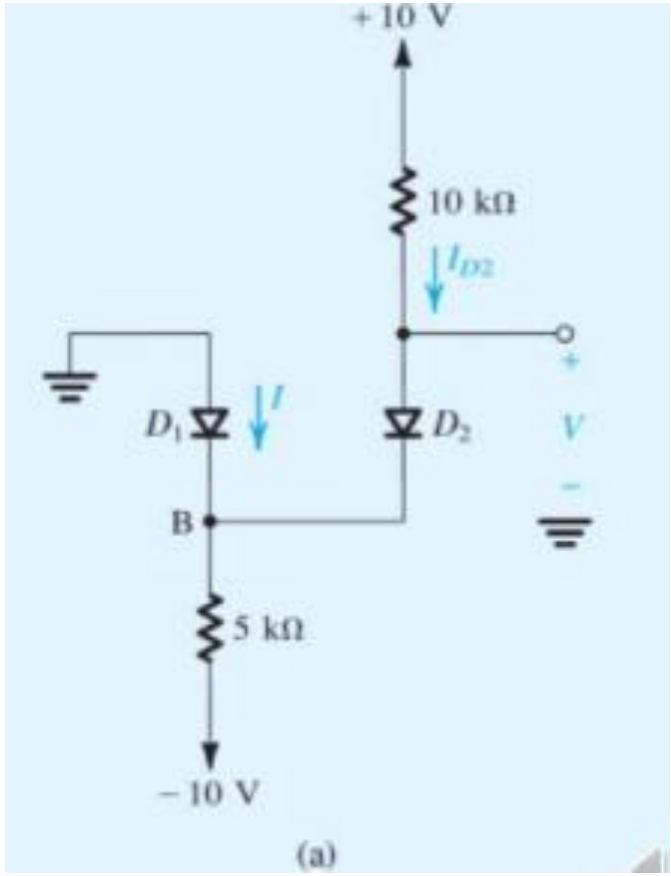
At node B

$I+I_{D2}=I_{5K\Omega}$

I+1mA=(0-(-10)/5

Then I=1 mA

$V=V_B$=0V



Example

For circuit shown in Fig (b)

Assume diode D_1 is on, so V_B=0v

Then diode D_2 will be on

I_{D2}=(10-0)/5 = 2mA

At node B

$I+I_{D2}=I_{10K\Omega}$

I+2mA=(VB-(-10)/10=(0-10)/10=1mA

Then I=-1 mA,

so diode D_1 will be off (open circuit) and

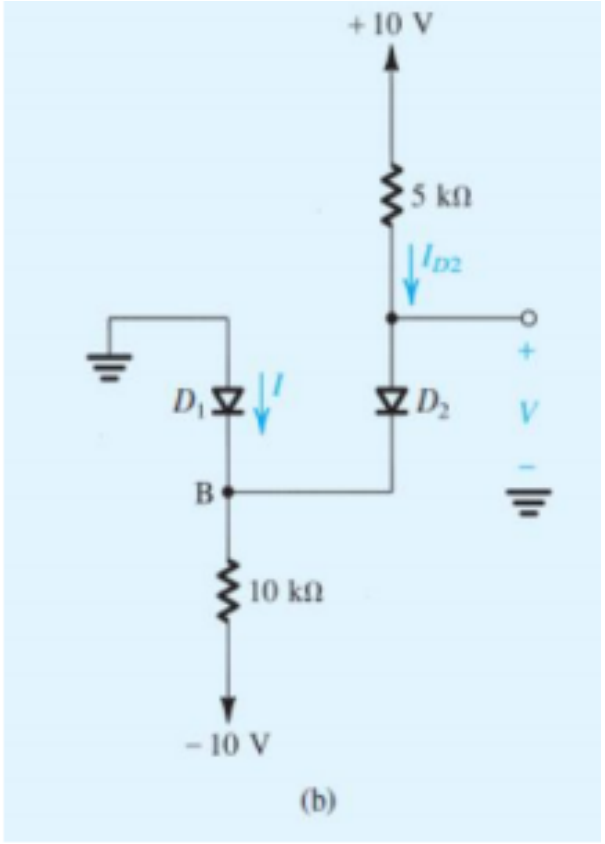
I= 0 mA

While diode D_2 will be on, so

$I_{D2}= I_{5K\Omega}= I_{10K\Omega}$ = (10-(-10)/(5+10)=20/15=1.333mA

V=10-1.333*5=3.3333V, or

V= - 10+1.333*10=3.3333V



Thank you