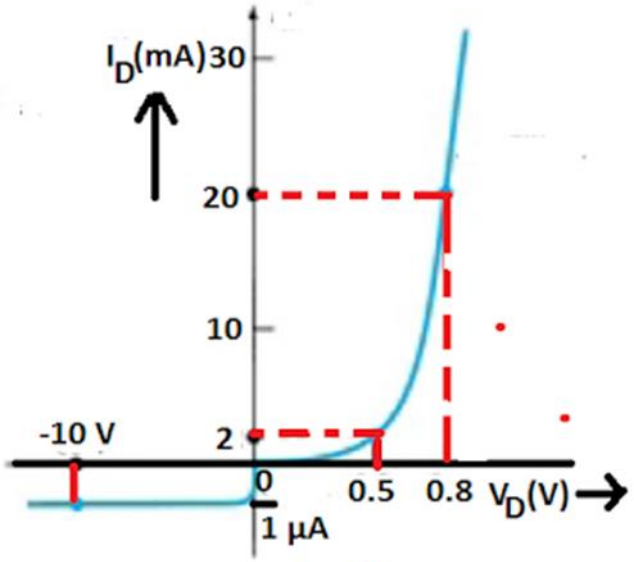
Electronics I

Lecture 2

Q1/ **Calculate the DC resistance of the diode of the following V-I curve.**

a) I_D = 2 mA
b) I_D = 20 mA
c) V_D = -10 Volts



a) at I_D= 2 mA , V_D = 0.5 V

$$R_{DC} = \frac{V_D}{I_D} = \frac{0.5V}{2\,mA} = 250\ \Omega$$

b) at I_D=20mA , V_D = 0.8 V

$$R_{DC} = \frac{V_D}{I_D} = \frac{0.8V}{20\,mA} = 40\ \Omega$$

c) at V_D = - 10 V, I_D = - 1 µA

$$R_{DC} = \frac{V_D}{I_D} = \frac{10\ V}{1\ \mu A} = 10\ M\Omega$$

Q2/

A germanium diode has a reverse saturation current of 0.19μA. Find the current in the diode when it is forward biased with 0.3V at 27°C.

Given:

$I_o = 0.19\mu A,\ V_D = 0.3V,\ T = 27°C,\ \eta = 1\ for\ Germanium\ Diode,\ and\ I_D = ?$

$$I_D = I_o\left(e^{V_D/\eta V_T} - 1\right)$$

$$=> I_D = 0.19 \times 10^{-6} \times \left(e^{0.3V/1\times 25.862\times 10^{-3}} - 1\right)$$

$$=> I_D = \mathbf{20.72\ mA}$$

$$V_T = \frac{T}{11{,}600}$$

$$= \frac{273° + 27°}{11{,}600}$$

$$= 25.862mV$$

Q3/

The forward current in a Silicon Diode is 15mA at 27°C. If reverse saturation current is 0.24nA, what is the forward bias voltage?

Given:

$I_D = 15mA,\ I_o = 0.24nA,\ T = 27°C,\ \eta = 2\ for\ Si\ Diode,\ and\ V_D = ?$

$$I_D = I_o\left(e^{V_D/\eta V_T} - 1\right)$$

$$=> V_D = \eta V_T \ln\left(\frac{I_D}{I_o} + 1\right)$$

$$=> V_D = 2 \times 25.862mV \times \ln\left(\frac{15m}{0.24n} + 1\right)$$

$$\mathbf{V_D = 0.928V}$$

$$V_T = \frac{T}{11{,}600}$$

$$= \frac{273° + 27°}{11{,}600}$$

$$= 25.862mV$$

Q4/

A silicon diode is reverse biased with 5V at room temperature. If reverse saturation current is 60pA, what is the diode current?

Given, $V_D = -5V$, $I_o = 60pA$, $T = 27°C$, $\eta = 2$ *for Si Diode, and* $I_D = ?$

$$I_D = I_o\left(e^{V_D/\eta V_T} - 1\right)$$

$$=> I_D = 60pA \times \left(e^{-5/2\times 25.862m} - 1\right)$$

$$=> I_D = \mathbf{-60\ pA}$$

$$V_T = \frac{T}{11{,}600}$$

$$= \frac{273° + 27°}{11{,}600}$$

$$= 25.862mV$$

Q5/

❖ . A germanium diode carries a current of 10mA when it is forward biased with 0.2V at 27°C. (a) Find reverse saturation current. (b) Find the bias voltage required to get a current of 100mA.

Given, $I_D = 10mA$, $V_D = 0.2V$, $t = 27°C$, $\eta = 1$ *for Ge Diode*

(a) $I_o = ?$

$$I_o = \frac{I_D}{\left(e^{V_D/\eta V_T} - 1\right)}$$

$$I_o = \frac{10m}{\left(e^{0.2/1\times 25.862m} - 1\right)} \quad => \mathbf{I_o = 4.3816\mu A}$$

$$V_T = \frac{T}{11{,}600}$$

$$= \frac{273° + 27°}{11{,}600}$$

$$= 25.862mV$$