MINISTRY OF HIGHER EDUCATION AND SIENTIFIC RESEARCh - SAWA UNIVERSITY - ENGINEERING COLLEGE -PHYSICS DEPT. SECOND STAGE 2.nd COURSE

جامعة ساوة الاهلية

كلية التقنيات الهندسية

القسم: الفيزياء الطبية والعلاج الاشعاعي

المرحلة الثانية /الفصل الثاني

عنوان المحا ضرة:

Types of currents in reverse bais

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رقم المحا ضرة (3)

the third lecture

بسم الله الرحمن الرحيم

IN THE NAME OF GOD, THE MOST GRACIOUS, THE MOST MERCIFUL

Department of Physics and Radiotherapy

Types of currents in reverse bais

There are four types of currents in reverse bais :

1- Minority carriers current

2-Surface- leakage current

3- Ephemeral acrossing current

The formula used in the P-N junction to find barrier potential as in following equation:

$$\mathbf{V_B} = \frac{kT}{q} \ \mathbf{ln} \left[\frac{\mathbf{ND*NA}}{(ni)^2}\right] \qquad \text{-------------------------- } \mathbf{(1)}$$

k ≡ poltsman constant
T≡ Temperature degree
q≡ electron charge
ND ∗ NA ≡ are the impurities concentrations.
ni ≡ is the intrinsic concentration
VB≡ barrier potential≡

Example (1) calculate the barrier potental if you have :
Nd=$10^{15}\ cm^{-3}$
Na=$10^{18}\ cm^{-3}$
room temperature = 27 c
ni = 1.45 x $10^{10}\ cm^{-3}$

Solution :

$$V_B = \frac{kT}{q}\ln(\frac{N_d N_a}{n_i^2}) \quad ,T = 300K, q = 1.6\times10^{-19}C, k = 1.38\times10^{-23}J/K$$

$$V_B = \frac{(1.38\times10^{-23})\times300}{1.6\times10^{-19}}\ln[\frac{(10^{15})\times(10^{18})}{(1.45\times10^{10})^2}]$$

$$V_B = 258.75\times10^{-4}\ln[\frac{10^{33}}{2.1025\times10^{20}}]$$

$$V_B = 0.025875\times\ln[4.756\times10^{12}]$$

$$V_B = 0.7553\,V$$

Carrier Lifetime (τ)

The carrier lifetime (or simply the lifetime) is generally referred to as the time during which a charge carrier is free to move and so to contribute to electric conduction. We can define τ_n as the time that an excited electron spends in the conduction band and τ_p as the time that an excited hole spends in the valence band . Supposing that a uniform excitation generates G electron–hole pairs per second per unit volume in a solid, then the generated electron and hole densities in the conduction band and valence band are, respectively:

$\Delta n = G\tau_n$ and $\Delta p = G\tau_p$

In the steady state, the rate of generation is equal to the rate of trapping. thus we have

$\Delta n = \Delta p$

then

$\tau_n = \tau_p$

Rectification
(1) Half -wave rectifier by single silicon diode

Typically ,it converts an AC signal to DC by passing either the negative or positive half-cycle of the waveform and blocking the other. Half-wave rectifiers can be easily constructed using only one diode, but are less efficient than full-wave rectifiers as shown in figure (14) below:

$V_{DC} = V_{ave} = \frac{Vp}{\pi}$ ------------- (5)

(peak inverse voltage) (PIV) $= V_M = V_{p2}$ -------------(6)

$F_{out} = F_{in}$ --------------(7)

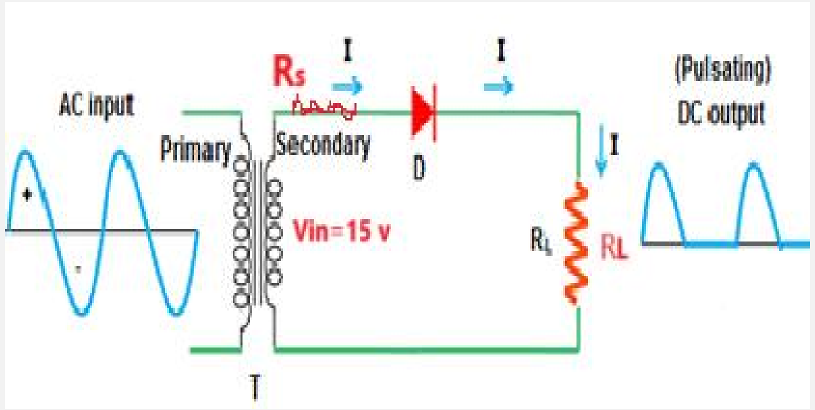


Figure (14) **half-wave rectifier**

Example (3)

In the below figure find the

(a) V_{DC}

(b) V_M

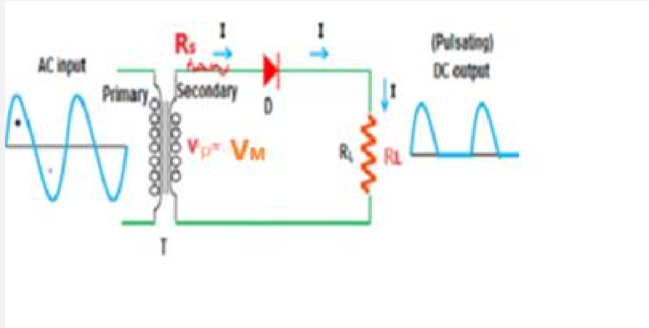
(c) F_{out}

If you know that ratio between the turns of primary and secondary coils is:

$$\frac{N1}{N2} = \frac{4}{1}$$

$F_{in} = 50$ Hz

$V_{in} = 120v$



Solution :

maximum primary voltage is $V_{p1} = \sqrt{2}\ V_{RMS} = \sqrt{2}\ x120v = 170v$

Hence, the maximum secondary voltage is

$V_{p2} = \frac{N2}{N1}$ x $V_{p1} = \frac{1}{4}$ x170v = 42.5

therefor , $V_{DC} = \frac{Vp}{\pi} = \frac{42.5v}{3.14} = 13.5v$

PIV $=V_{p2}$ =42.5v

$F_{out} = F_{in}$ =50Hz

انتهى .... شكرا لاستماعكم