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# ASSIGNMENT-1

## Answer-1:-

i) Maximum peak to peak voltage = 60V

$\therefore V_m = \frac{60}{2} = 30V$

$\therefore$ Peak current $(I_m) = \frac{V_m}{r_d + R_L}$ {where $R_L = 500\Omega$ and $r_d = 50\Omega$}

$\therefore I_m = \frac{30}{50 + 500} = 0.054A$

Average Current $(I_{avg.}) = \frac{2I_m}{\pi} = \frac{2 \times 0.054}{3.14} = 0.034\ A$

RMS value of current $(I_{RMS}) = \frac{I_m}{\sqrt{2}} = \frac{0.054}{\sqrt{2}} = 0.038\ A$

ii) Form Factor $= \frac{I_{RMS}}{I_{avg}} = \frac{\pi}{2\sqrt{2}} = 1.11$

$\therefore$ Ripple Factor $= \sqrt{(1.11)^2 - 1} = 0.481$

iii) Efficiency $= \frac{1}{(1.11)^2\left(1 + \frac{50}{500}\right)} = \frac{1}{(1.11)^2(1.1)} = 0.7378$

$= 73.78\%$

## Answer 2:-

$I_S = 5 \times 10^{-6} A$, $I_D = 50 \times 10^{-3} A$, $\eta = 1$ for Ge.

$T = 300k$.

We know $V_T = \frac{k \cdot T}{q}$ {where $k = 1.38 \times 10^{-23}$ J/k and $q = 1.6 \times 10^{-19} C$}

$\therefore V_T = \frac{1.38 \times 10^{-23} \times 300}{1.6 \times 10^{-19}} = 0.0258$

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We know; $I_D = I_S \left[ e^{\frac{V_D}{\eta V_T}} - 1 \right]$

$\therefore 50 \times 10^{-3} = 5 \times 10^{-6} \left[ e^{\frac{V_D}{0.0258}} - 1 \right]$

$\Rightarrow e^{\frac{V_D}{0.0258}} = 10001$

$\Rightarrow \frac{V_D}{0.0258} = \ln(10001)$

$\Rightarrow V_D = 9.21 \times 0.0258 = \underline{0.2376\ V}$

## Answer - 3:-

a)

| | Avalanche Breakdown | Zener Breakdown |
|---|---|---|
| i) | The breakdown value is greater than 8V. | The breakdown value is between 5V and 8V. |
| ii) | Increase in temperature increases the breakdown voltage. | Increase in temperature decreases the breakdown voltage. |
| iii) | Occurs in diodes that are lightly doped. | Occurs in diodes that are heavily doped. |

b)

| | Drift Current | Diffusion Current |
|---|---|---|
| i) | Electric field / biasing is required. | Electric field / biasing is not required. |
| ii) | Caused due to the flow of minority charge carriers. | Caused due to the flow of minority charge carriers. |
| iii) | Ohm's laws can be applied | Ohm's laws cannot be applied. |

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**Answer – 4:-**

$V_{DD} = 5V$; $R = 1 \times 10^3 \Omega$, $V_t = 0.65V$, $r_d = 20 \Omega$

Applying KVL in the circuit :-

$$-V_{DD} + V_t + I_D (R + r_d) = 0$$

$$\Rightarrow I_D = \frac{V_{DD} - V_t}{R + r_d}$$

$$\Rightarrow I_D = \frac{5 - 0.65}{1 \times 10^3 + 20} = 4.264 \times 10^{-3} A$$

$$= 4.264 \text{ mA}$$