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EDC - Int Test-4

$\eta = 0.72$

$\lambda = 890\,nm$

$P = 0.75\,\mu W$

$I_M = 15\,\mu A$.

$M = ?$

$\lambda = \frac{1.24}{E_g\,eV}$

$\Rightarrow E_g\,eV = \frac{1.24}{\lambda} = \frac{1.24}{0.89} = 1.3932\,eV.$

$R = \frac{\eta \times e}{h\nu} = \frac{0.72 \times e}{1.3932 \times e} = 0.516\,A/W$

$M = \frac{\text{Multiplied Photo current}}{\text{Primary Photo current.}} = \frac{I_m}{I_p}.$

$I_p = R \times P$

$= 0.516 \times 0.75\,\mu A$

$I_p = 0.387\,\mu A.$

$M = \frac{15}{0.387} = 38.759$

$\boxed{M = 38.759}$ ≈ 38 (Int)

Depletion layer Width $= 30\mu m$

Carrier Velocity $= 3 \times 10^4\,m/s.$

$\tau_{drift} = \frac{W}{v_{drift}} = \frac{30 \times 10^{-6}}{3 \times 10^4} = 1 \times 10^{-9}$ sec

$\boxed{\tau_{drift} = 1ns}$

$\eta = 70\% = 0.7$

$P = 0.5\mu W$

$\lambda = 900nm$

Input current = $10\mu A$.

$R = \frac{\eta}{1248} \times \lambda(nm) = \frac{0.7}{1248} \times 900 = 0.504$

$\boxed{R = 0.504}$

$I_{incident} = R \times P = 0.504 \times 0.5\mu A = 0.252\mu A$

$M = \frac{I_m}{I_p} = \frac{10}{0.252} = 39.68 \sim 39$ (Int)

$\boxed{M = 39}$

$\lambda = 0.85\mu m$ Spectral Width = 0.15 mm

$L = 150 Km$

$B = 622 Mbps$

$T_{tx} = 0.1ns$

$T_{rx} = 0.5ns$

$D = 18 ps/km\text{-}nm$

$\boxed{\text{For NRZ } T_{sys} \leq 0.7 T_b.}$ — (1)

$T_{fiber} = D \times \lambda \times L.$

$= \frac{18 \times 10^{-12}}{10^{-9}} \times 0.85 \times 10^{-6} \times 150 \times 10^{3}$

$= 18 \times 0.85 \times 10^{-12+9-6}$

$\boxed{T_{fiber} = 15.3 ns.}$

$T_{system} = \sqrt{T_{Tx}^2 + T_{Rx}^2 + T_{fiber}^2}$

$= \sqrt{(15.3)^2 + (0.5)^2 + (0.1)^2}$

$T_{system} = 15.308 ns.$

$B = \frac{1}{T_b} \Rightarrow T_b = \frac{1}{B} = \frac{1}{622\times10^6} = 1.6077\times10^{-9}$

$T_b = 1.6077\,ns.$

Checking condition of equation 1 we get

$15.308 \nless 1.6077\times0.7$

$15.308 \nless 1.12$

Hence NRZ system is not possible.

W = Depletion layer = 30 μm

v_d = Carrier velocity = 3×10^4 m/s

$B_m = \frac{v_d}{2\pi W} = \frac{3\times10^4}{2\pi\times30\times10^{-6}} = \frac{3\times10^{10}}{60\pi}$

$B_m = 159149491 = 159.15MHz$

$\boxed{B_m = 159.15MHz}$

$\eta = 75\%$. $\lambda = 850nm$

$M = 100$ $P_0 = 12nW$.

Responsivity at M=1

$R = \frac{\eta\times e\lambda}{hc} = \frac{0.75\times1.6\times10^{-19}\times850\times10^{-9}}{6.626\times10^{-34}\times3\times10^8}$

$= 0.514\,A\,W^{-1}$.

I_{pn} = primary current and $R = \frac{I_{pn}}{P_0}$

$I_{pn} = R\times P_0 = 0.514\times12\times10^{-9} = 6.168$

Photodiode current $I_M = M\times I_{pn} = 100\times6.168\times10^{-9}$

$\boxed{I_M = 6.168\times10^{-7}\,A}$