۹۷۲۲۴۹۹ سامان وحیدی نیا

(1)

$$\frac{P_{r_n}}{P_{t_n}} = 10000$$

$$P_{loss} = -12\,dB \quad , P_{gain} = 10\log_{10}^{10000} = 40\,dB$$

$$\Rightarrow 10\log_{10}^{100^2} = 40 - 12 + n \Rightarrow n = 20 - 28 = -8\,dB$$

(2)

$$R = w\log_2(1+\frac{S}{N}) \Rightarrow 10\log_{10} P_{t_n} = 20 \Rightarrow P_{t_n} = 100\,mw$$

$$loss = -5 \Rightarrow 10\log_{10}^{\frac{P_{r_n}}{P_{t_n}} \to \frac{S}{N}} = -5 \Rightarrow \frac{P_{r_n}}{P_{t_n}} = 10^{-\frac{1}{2}} \Rightarrow P_{r_n} = 10^{\frac{1}{2}} \times 10^{2} = 10^{\frac{3}{2}}\,mw \downarrow S$$

$$C = 2\times10^6 \log_2(1+\frac{10^{\frac{3}{2}}}{10}) = 2\times10^6 \log_2(1+10^{\frac{1}{2}})$$

(3) الف)

$$m = 5 \Rightarrow C = 2wm \Rightarrow 2\times10^5 = 2\times5\times w$$

$$\Rightarrow w = 2\times10^3\,hz$$

ب)

$$C = w\log_2(1+\frac{S}{N}) \Rightarrow 2\times10^5 = 2\times10^4 \log_2(1+\frac{S}{N})$$

$$\Rightarrow \frac{S}{N} = 2^{10} - 1 = 1023$$

(4)

$$10\log_{10}\frac{E_b}{N_0} = 10\log_{10}\frac{S}{N} + 10\log_{10}W - 10\log_{10}R$$

$$\Rightarrow 2.5 = 10\log_{10}100 + \log_{10}\frac{W}{R}$$

$$\Rightarrow \log_{10}\frac{W}{R} = -17.5 \Rightarrow \frac{W}{12\times10^4} = \frac{1}{10^{1.75}} \Rightarrow W = \frac{12\times10^5}{10^{1.75}}$$

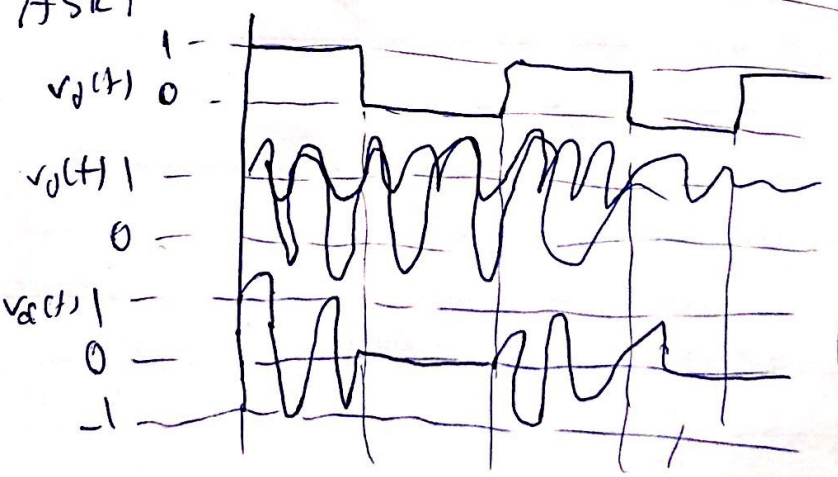
(5)

$W = 10 + 9 = 10\times4 + 9\times0.5 = 4.45\ kHz$

channels, guard band

(6)

Ask,



something like that

slide 2.5

slide 2.5 for fsk

$v_c(t) = \cos\omega_c t \quad \omega_c = 2\pi f_c$

$f_c = 10^3\ hz \quad R = 500\ bps \quad v_c(t) = \cos 2000\pi t$

$T = \frac{1}{1000}$