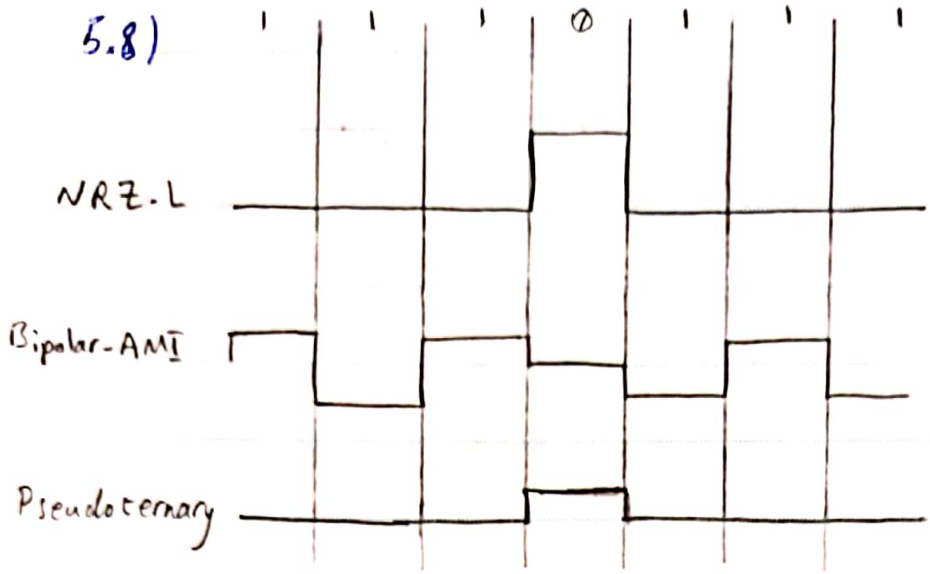
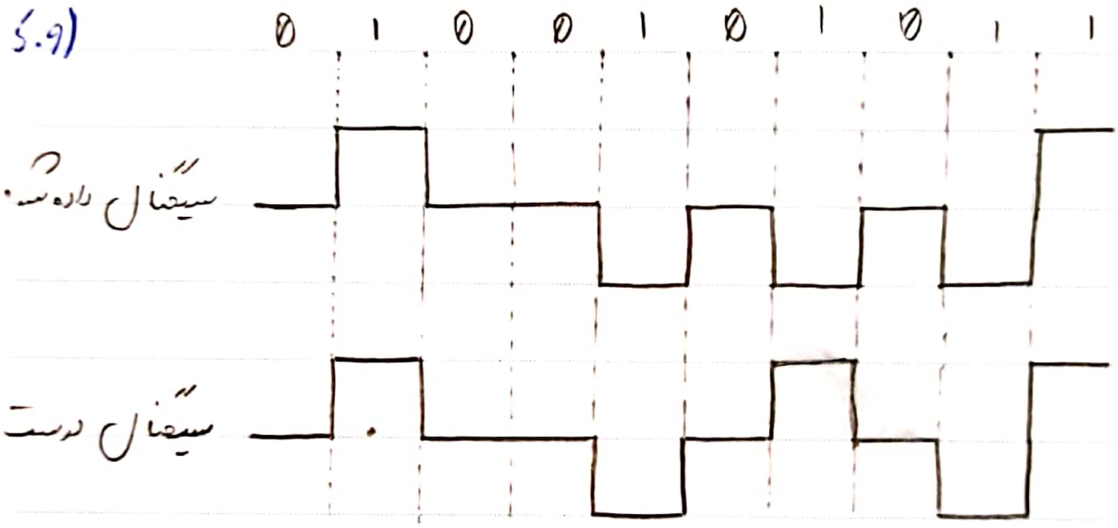
حل تمرین سری 2

Subject | Year: | Month: | Date:

5.8)



5.9)



5.12) $\frac{E_b}{N_0} = \frac{S}{N} \cdot \frac{B}{R}$

توان سیگنال : $S = \lim_{T\to\infty} \frac{1}{2T}\int_{-T}^{T} s^2(t)\,dt = \lim_{T\to\infty} \frac{1}{2T}\int_{-T}^{T} 25\times10^{-6}\sin^2(2\pi 10^6 t+\theta)\,dt$

$= \frac{25\times10^{-6}}{2} \lim_{T\to\infty} \frac{1}{2T}\int_{-T}^{T} 1-\cos(4\pi 10^6 t+2\theta)\,dt$

$= \frac{25\times10^{-6}}{2}\left[\frac{2T}{2T} - \underbrace{\lim_{T\to\infty}\frac{\text{finite}}{2T}}_{0}\right] = \frac{25\times10^{-6}}{2}\,W$

رابطه‌ی نایکوئیست : $C = 2B\log_2 M \Rightarrow \frac{C}{B} = \frac{R}{B} = 2\log_2 M$

$\xrightarrow{PSK} \frac{R}{B} = 2$

$\xrightarrow{QPSK} \frac{R}{B} = 4$

PSK: $\frac{E_b}{N_0} = \frac{25\times10^{-6}}{2\times2.5\times10^{-8}} \times \frac{1}{2} = 250 = 23.97\,dB$

QPSK: $\frac{250}{2} = 125 = 20.97\,dB$

5.14) Bandwidth efficiency $= \frac{R}{B} = 1$

$\frac{E_b}{N_0} = \frac{S}{N} \cdot \frac{B}{R} \Rightarrow \frac{E_b}{N_0} = \frac{S}{N}$

$BER = 10^{-6}$

$\xrightarrow{ASK} \frac{E_b}{N_0} = 13.5\,dB$ (شکل 5.8 کتاب)

$\xrightarrow{FSK} \frac{E_b}{N_0} = 13.5\,dB$ (شکل 5.13a کتاب)

$\xrightarrow{PSK} \frac{E_b}{N_0} = 10.3\,dB$ (شکل 5.13b کتاب)

$\xrightarrow{QPSK} \frac{E_b}{N_0} = 10.8\,dB$ (" " ")

5.20) $(SNR)_{dB} = 6.02n + 1.76 = 60.2 + 1.76 = 61.96\,dB$

5.21) a) $30 = 6.02n + 1.76 \Rightarrow n = \lceil 4.69 \rceil = 5 \Rightarrow M = 2^n = 32$

b) $7000 \times 5 = 35\,kbps$