Module 3F4, May 2003

DATA TRANSMISSION

Answers

1   (b) $b_0 = 1.1111, \;\; b_1 = 0.5556, \;\; b_2 = -0.0926$

            Without equalisation, BER $= 0.2267$;   with equalisation, BER $= 0.00109$

      (c)   DFE BER $= 3.4 \, . \, 10^{-6}$

2   (a)   (ii) $S_x(\omega) \; = \; \dfrac{0.04 \, . \, 2\pi}{T_s^2} \displaystyle\sum_{m=-\infty}^{\infty} \delta\left(\omega - m\dfrac{2\pi}{T_s}\right) \; + \; \dfrac{1}{T_s}\, \sin^2\left(\dfrac{\omega T_s}{2}\right)$

      (b) $S_y(\omega) \; = \; S_x(\omega) \left| \dfrac{T_s}{2}\left[\, \text{sinc}\left(\dfrac{\omega T_s - \pi}{2}\right) \; + \; \text{sinc}\left(\dfrac{\omega T_s + \pi}{2}\right)\right]\right|^2$

3   (a)   Simplified result (matched correlation demodulator):

            Detect polarity of $y(k) = \displaystyle\int_{kT_b}^{(k+1)T_b} Re[r(t)\, g(t - kT_b)\, e^{-j\phi_0}]\, dt$

      (b)   BER $= 0.0295$

      (c)   Bandwidth $\simeq 50$ kHz

      (d)   16-QAM

4   (a)   QPSK phasor waveform for k^{th} symbol period:

            $p_k(t) = [b_{2k} + j\, b_{2k+1}]\, g(t - kT_s)\, e^{j\phi_0}$ where $b_i = \pm 1$

      (b)   User bit rate $= 1.2$ Mb s^{-1}

      (c)   Max path delay variation $\simeq 0.42$ ms