93學年度國立成功大學 電信管理研究所 乙組 通訊導論 試題 共 1 頁 第 1 頁
研究所招生考試

1. In wireless communication systems, the carrier frequency on the uplink is smaller than the carrier frequency on the downlink. Justify the rationale for this choice. (10%)

2. Describe how and why pre-emphasis/de-emphasis techniques are used in FM systems. (10%)

3. Consider the (7, 4) Hamming code defined by the generator polynomial

$$g(X) = 1 + X^2 + X^3.$$

The code word 0111001 is sent over a noisy channel, producing the received word 0101001 that has a single error. Determine the syndrome polynomial $s(X)$ for this received word, and show that it is identical to the error polynomial $e(X)$. (15%)

4. A waveform, $x(t)=10\cos(500t+\pi/3)+29\cos(2000t+\pi/6)$ is to be uniformly sampled for digital transmission. Each sample is represented by 16 bits.
(a) What is the maximum allowable time interval between sample values that will ensure perfect signal reproduction? (5%)
(b) If we want to reproduce 1 hour of this waveform, how many memory are needed to store the sampled data (in byte) ? (5%)

5. (a) What is the value in decibels of the free-space loss for a carrier frequency of 100 MHz and a range of 5 km? (5%)
(b) The transmitter output power is 10 W. Assume that both the transmitting and receiving antennas are isotropic and that there are no other losses. Calculate the received power in dBW. (10%)
(c) If in part (b) the EIRP is equal to 20 W, calculate the received power in dBW. (5%)

6. Given the data stream 1110010100, sketch the transmitted sequence of pulses for each of the following line codes:
(a) Polar nonreturn-to-zero (5%)
(b) Unipolar return-to-zero (5%)
(c) Bipolar return-to-zero (5%)
(d) Manchester code. (5%)

7. Binary data are transmitted over a microwave link at the rate of 10^6 bits/s, and the power spectral density of the noise at the receiver input is 10^{-10} W/Hz. Find the average carrier power required to maintain an average probability of error $P_e \leq 10^{-4}$ for DPSK. (15%)

Note: $\log_{10}(2)=0.3010$, $\log_{10}(3)=0.4771$, $\log_{10}(5)=0.6990$, $\log_{10}(7)=0.8451$,
$\ln(2)=0.6931$, $\ln(3)=1.0986$, $\ln(5)=1.6094$, $\ln(7)=1.9459$,
$\log_{10}(e)=0.4343$, $\log_a(b)=\log_x(b)/\log_x(a)$