Unit 8: Physical Layer Exercises

Questions

C1. What is Delay Distortion? Why does it occur?

C2. If we transmit two signals with similar characteristics, at the same rate, over two transmission different bandwidth channels, will the received signals remain similar?

Problems

1. Given the signal: s (t) = 6sen (2πf1t) + sin (2 * 2πf1t) + 4sen (4 * 2πf1t), with f1 = 2MHz:
    a. Plot the signal in the frequency domain.
    b. Calculate the signal bandwidth.
    c. Calculate the transmission rate if you are transmitting 2 bits per period.
2. Suppose we transmit the character of 8 bits (01000001) indefinitely by a periodic signal. The transmission channel acts as a low pass filter with a cut off frequency of 3000Hz. What is the achievable data rate if only the first five components of the signal can be transmitted?
3. Encode the bit-pattern 01100011 using the following digital encoding schemes.
    a. RZ
    b. Manchester
4. What is the baud rate of a digital signal that employs Manchester encoding and has a data transfer rate of 2000 bps?
5. Suppose we transmit the sequence 1111…. indefinitely using Manchester encoding over an unshielded twisted pair (UTP) category 3 cable of a bandwidth of 16 MHz. The first 16 harmonics are required for a proper signal reception. Calculate the maximum transmission rate.
6. Suppose a telephone modem operating at a modulation rate of 2400 bauds, and its transmission rate is 33600 bps. Calculate how many bits at time can be transmitted per signal element.
7. Encode 10011001 character using NRZ encoding and Manchester encoding. If that character is continuously transmitted to 1Gbps, what is the modulation rate in each case?
8. Suppose we transmit over a channel with a bandwidth of 30000 Hz
    a. Calculate how many harmonics are sent if the 6 bit character 010000 is periodically transmitted at a rate of 9600 bps using NRZ coding.
    b. If we increase the transmission rate, will it receive more or less harmonics? Justify your answer.
9. Calculate the modulation rate using a standard 9600 bps modem that uses 12 phase angles, four of which have two amplitude values.