BIT 5203 – Computer and Communication Networks

Department of Communications and Computer Engineering
University of Malta

Tutorial 2

1) Analogue and Digital data can be represented using Analogue or Digital signals, discuss.

2) What is the difference between a periodic and an aperiodic signal?

3) Given the frequencies (a) 50 Hz, (b) 1 MHz, (c) 200 kHz, calculate the corresponding periods.

4) What is the phase shift in degrees and in radians of a sine wave which is offset (a) ¼ of a cycle and (b) ¾ of a cycle with respect to time zero?

5) Draw the time-domain sine wave having a maximum amplitude of 30 V, a frequency of 10 Hz and a phase of 90° (show only 1 second).

6) A periodic composite signal has a bandwidth of 5 kHz and is composed of three sine waves. The first one has a frequency of 250 Hz and an amplitude of 5 V, the second one has a frequency of 2.5 kHz and an amplitude of 10V, while the third has an amplitude of 2 V. Draw the frequency spectrum.

7) What is the bit rate of the following signals: (a) A signal in which 1 bit last 10 ms, (b) A signal in which 10 bits last 25 μs, (c) A signal in which 250 bits last 100 ps.

8) Find the bit duration for a signal having a bit rate (a) 300 bps, (b) 250 kbps, (c) 5 Mbps.

9) Draw the frequency domain representation of the following signal: $s(t) = 10 + 5\sin 600\pi t + 3\sin 1200\pi t$

10) A signal passing through a radio channel has been attenuated by 20 dB, what was the original signal power if the receiver captured a 200 mW signal.

11) The spectrum of a channel lies between 100 Hz and 10 MHz. If the measured signal-to-noise ratio (SNR) is 25 dB, find the capacity of the channel. What are the number of signal levels that can be accommodated?

12) A data stream, 1011001011, is to be sent over a channel, encode this data using (a) Unipolar, (b) NRZ-L, (c) NRZ-I, (d) RZ and (e) Manchester.

13) Use the Huffman coding algorithm to encode the set of symbols A, B, C, D, E, F, G, H, I having probabilities 5%, 6%, 4%, 10%, 25%, 12%, 8%, 14%, 16% respectively.

14) Describe the Pulse Code Modulation scheme.

15) Using Nyquist Theorem, calculate the sampling rate for the following analogue signals: (a) a signal having a bandwidth of 4 kHz, (b) a signal with frequencies between 3.5 kHz and 6 kHz.

16) A sample represents one of four levels. If the sampling rate is 16,000 samples per second, calculate the bit rate.

17) Describe the serial and parallel mode of transmission.

18) Describe Amplitude Shift Keying.

19) Describe Frequency Shift Keying.

20) Describe Phase Shift Keying.

21) Given a bandwidth of 15 kHz, calculate the baud rate and the bit rate for (a) ASK, (b) FSK having a carrier difference of 6 kHz, and (c) 16-PSK.

22) Compute the baud rate for a 1 Mbps 64-QAM signal.

23) Calculate the bandwidth required for the following AM signals; (a) modulating signal with a bandwidth of 10 kHz, (b) modulating signals with frequencies between 2000 and 4000 Hz.

24) Calculate the bandwidth required for the following FM signals; (a) modulating signal with a bandwidth of 10 kHz, (b) modulating signals with frequencies between 2000 and 4000 Hz.

25) Describe Frequency Division Multiplexing.

26) Describe Wave Division Multiplexing.

27) Describe Time Division Multiplexing.

28) Ten digital data channels, each transmitting at 1 Mbps, use a 5 MHz wireless channel. Design an appropriate configuration using FDM assuming a guard band of 50 kHz.

29) Ten digital data channels, each transmitting at 1 Mbps, are multiplexed using TDM. Find (a) the bit duration before multiplexing, (b) the transmission rate of the link, (c) the duration of a time slot, (d) the duration of a frame.

30) Describe the Interleaving process.

31) Discuss how are frames synchronized in TDM and how different data rates can be multiplexed.

32) Five signal sources are multiplexed using TDM. Each source produces 500 characters per second. Assume that there is a byte interleaving and that each frame requires two bits for synchronization. Calculate the frame rate and the bit rate on the link.