Khulna University
Computer Science and Engineering Discipline
3rd Year Term II Final Examination 2016
Session: 2014-2015
Course No: ECE 3251
Full Title of Course: Data Communication

Full Marks: 60   Time: 03 Hours

- The figures in the margin indicate full marks. The questions are of equal value.
- Use separate sheet for each section.

Section A
There are **FOUR** questions in this section. Answer any **THREE** questions

1. (a) Define the following terms: 05
    Analog and Digital transmission system.
   (b) Explain amplitude modulation technique with its standard equation.   03
   (c) A carrier of 10V peak and frequency 100KHZ is amplitude modulated by   04
       a sine wave of 4V peak and frequency 1000HZ. Determine the
       modulation index for the modulated wave and draw the amplitude
       spectrum.

2. (a) Write down the sampling theorem and explain its significance on   03
    communication system.
   (b) Prove the following statement: At 100% modulation, total power of a   03
       modulated signal is $P_T = (3/2)P_C$, where symbols have their usual
       meanings.
   (c) Define PAM. Also draw the neat sketch of PAM with natural sampling.   03
   (d) What do you mean by aperture effect?   01

3. (a) Define SNR. Show that, the product of two significant parameters for   04
    digital transmission system, R_b/B_T and E_b/N_0 is equal to SNR.
    [Symbols have their usual meanings]
   (b) Explain the technique of full-duplex FSK transmission system on a   03
       voice-grade line.
   (c) A sinusoidal signal with a maximum peak input voltage of 5V is applied   03
       to a PCM channel using a 10-bit code word. Find:
       i. The number of quantization levels used
       ii. The maximum sinusoidal signal to quantization noise ratio in
           Decibels.

4. (a) Draw up a table, showing how the sequence $d_k = 1011001$ would be   04
    encoded and decoded using DPSK technique.
   (b) Discuss the basic stages involved in the generation of PCM. Why is   03
       compressor added in the generation of PCM?
   (c) Explain the fundamental concept of a constellation diagram with   03
       necessary figure.

5. (a) Define numerical aperture. Prove that $-NA = n_1(2\Delta)^{1/2}$, where symbols hold their usual meanings.   04

(b) In a fiber-optic cable, does the light energy from the source equal the light energy recovered at the destination?. Discuss this in terms of propagation mode.   03

(c) An optical fiber made of plastic with a refractive index of 1.53 and cladded with another plastic with a refractive index of 1.51. Launching takes place from air. Now calculate the following terms: 03

    i. Relative refractive index difference between core and cladding.

    ii. Numerical aperture.

    iii. Acceptance and critical angle.

6. (a) Define multiplexing and demultiplexing process. Write down the classification of multiplexing technique.   03

(b) Consider the TDM technique with three input signals and explain the interleaving process with the help of a diagram.   04

(c) Five channels are to be multiplexed together shown in the following figure. Find the minimum bandwidth of the link.   03
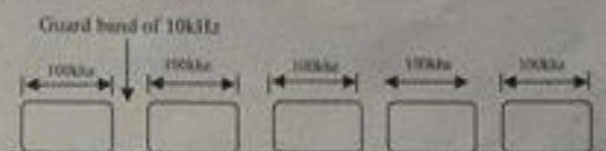
Guard band of 10kHz

Figure Q.6 (c)

7. (a) Explain sliding-window flow control protocol with necessary diagram.   04

(b) Consider a message of 10 bits, $M = 1101011011$. Pattern of 5 bits, $P = 10011$. For CRC error-detecting code, find the reminder R and transmitted bits in a polynomial form.   04

(c) How is synchronization provided for synchronous transmission?   02

8. (a) Write down the Shannon capacity formula. What is the channel capacity for a teleprinter channel with a 300-Hz bandwidth and a signal-to-noise ratio of 3dB?   03

(b) A discrete memoryless source has an alphabet of five symbols with their probabilities for its output, as given here: 05

Symbol	S_0	S_1	S_2	S_3	S_4
Probability	0.4	0.2	0.2	0.1	0.1

Compute Huffman Code for this source and find:

    i. The average code-word length

    ii. Calculate the entropy of the source

(c) What do you mean by data link control protocol?   02