Khulna University, Khulna

Computer Science and Engineering Discipline

3rd Year, Term II, Examination 2015

Session: 2013-2014

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.

Q1. a) Define data and signal. **02**

b) Explain how data is transmitted, with the help of a digital communication system. **03**

c) What is modulation? State the conditions to retain the shape of the envelop of the modulated signal same as the modulating signal. **02**

d) Classify modulation techniques for transforming digital data into analogue signals. Give one use of each technique. **03**

Q2. a) Describe the pulse width modulation technique with the variations of its modulating signals. **03**

b) A PCM system is to carry a 20-kHz music channel. It is to have a signal-to-noise ratio of 80 dB and the peak maximum signal is 15 dB over its rms value. **03**

i. What sampling rate should be used?

ii. How many bits should be used in the sample code word?

c) Explain with necessary figure how PPM wave can be generated from a PWM signal. **04**

Q3. a) For the situation of a maximum sized sinusoidal signal input, derive the equation $\left(\frac{S}{N}\right) q = 1.5L^2$. **03**

b) Describe binary frequency shift keying method. **03**

c) Given the bit pattern, 01100 encode this data using ASK, BFSK and BPSK. **03**

d) Why carrier recovery circuit is used? **01**

Q4. a) With the help of a block diagram, describe QPSK modulation and demodulation technique. **04**

b) Why should PCM be preferable to data modulation for encoding analogue signals that represent digital data? **03**

c) What do you mean by constellation diagram and draw a constellation diagram of 16 QAM system. **03**

SECTION B

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

Q5. a) For the bit stream 01001100011, sketch the waveforms for this sequence using: (i) NRZ-L; (ii) Bipolar AMI; (iii) Pseudoternary. **03**

b) State and prove the channel capacity theorem. **03**

c) Given a channel with an intended capacity of 20 $Mbps$ and the bandwidth of the channel is 3 MHz. What signal-to-noise ratio is required to achieve this capacity? **03**

d) What do you understand by the term mutual information? **01**

Q6. a) A discrete memoryless source has an alphabet of five symbols with their probabilities for its output, as given here: 04

Symbol	S_0	S_1	S_2	S_3	S_4
Probability	0.55	0.15	0.15	0.10	0.05

Compute Huffman code for this source and find:

i. The average code-word length

ii. Calculate the entropy of the source.

b) With the help of a Synchronous frame format, explain the synchronous transmission system. 03

c) What is multiplexing? Discuss about the time division multiplexing process. 03

Q7. a) Consider the (7, 4) Hamming code, whose parity check matrix is given by H in Figure 7 (a). 05

i. Find the minimum distance of the Hamming code.

ii. Determine the syndrome 's' of the Hamming code for single and double error patterns. From this, show that single errors are correctable and double errors are at least detectable.

$$H = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 \end{bmatrix}$$

Figure 7(a): Matrix 'H'

b) Draw the state diagram of the convolution encoder given in Figure 7(b). Consider the input bit stream in 10011. Find the encoded bit sequence of the given data. Also draw the trellis diagram of this data sequence. 05

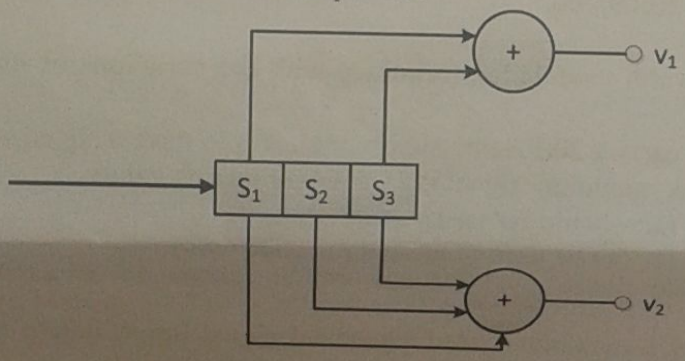

Figure 7(b): Convolution Encoder

Q8. a) How can you convert a general communication system into an optical fiber communication system? Explain with a block diagram. 03

b) A multimode step index fiber with a core diameter of 60 μm and a relative index difference of 1.5% is operating at a wavelength of 0.85μm. If the core refractive index is 1.48, then calculate: 03

i. The normalized frequency for the fiber.

ii. The number of guided modes.

c) Prove that, if the transmission times are to be the same, the bit energy for the coded signal must be reduced by a factor "r" compared to the uncoded signal. 04