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10SCN11

**First Semester M.Tech. Degree Examination, June 2012**  
**Advanced Digital Communication**

Time: 3 hrs.

Max. Marks:100

*Note: Answer any FIVE full questions.*

- 1 a. What are the goals of analog and digital transmission for long distance communication? Explain the functions of an analog repeater and a digital regenerator, using diagrams. (10 Marks)
- b. Explain QAM modulator, demodulator, and signal constellation diagram for 16 QAM, using diagrams. Assign gray code for the constellation. (10 Marks)

- 2 a. A high quality speech signal has a bandwidth of 8 kHz. Suppose that the speech signal is to be quantized and then transmitted over a 32 kbps modem. What is the SNR of the received speech signal? (04 Marks)
- b. A discrete memoryless source has an alphabet of five symbols with their probability as follows.

Symbol	S <sub>0</sub>	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>4</sub>
Probability	0.55	0.15	0.15	0.10	0.05

(i) Construct a Huffman tree and generate the Huffman code for the symbols, by placing the combined symbol as low as possible.

(ii) Find the entropy of the source.

(iii) Find the average code word length.

(iv) Find the variance of the average codeword length. (12 Marks)

- c. Suppose that WDM wavelength in the 1550 nm band are separated by 0.8 nm. What is the frequency separation in Hz? What is an appropriate bit rate for signals carried on these wavelengths? (04 Marks)

- 3 a. A 16 bit machine with 2's complement capability generates the following words: E34F 2396 4427 99F3. The message needs to be sent using internet check sum. Describe the action of internet check sum generator and the checker, assuming there are no transmission errors. (06 Marks)
- b. Compute the CRC check sum for the message sequence 0111 using  $x^5 + x^3 + x^1 + x^0$  as the generator polynomial. Draw only the block diagram for the CRC check sum implementation of the above, using shift registers. (10 Marks)
- c. State and explain Nyquist theorem and Shannon theorem. (04 Marks)

- 4 a. What is a line coder? Describe, using diagrams, any three categories of line codes and any three pulse shapes generally used for line coding. (10 Marks)
- b. Write briefly on the factors that need to be considered for selecting a line code. (06 Marks)
- c. A typical dial-up telephone connection has a band width of 3 kHz and a signal to noise ratio of 30 dB. Calculate Shannon limit. (04 Marks)

- 5 a. Draw a block diagram of a pcm system and explain briefly various signal processing operations. (10 Marks)

- b. Explain intersymbol interference in baseband binary data transmission system with block diagram. (04 Marks)

Important Note: 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8=50, will be treated as malpractice.

(04 Marks)

State and explain Nyquist's criterion for zero ISI.

(04 Marks)

- 6 a. A voice signal in the range of 300 to 3300 Hz is sampled at 8000 samples per sec. The samples may be transmitted either as PAM pulses or converted to PCM and transmitted.
- What is the minimum system band width required for the detection of PAM with no ISI and with a roll-off-factor of 1?
  - Using the same roll-off, what is the minimum band width required for the detection of binary pcm waveform, if the samples are quantized to 8 levels.
  - Repeat part ii, using 128 quantization levels. (08 Marks)
- b. The binary data 001101001 are applied to the input of a duo binary system.
- Construct the duo binary coder output and the corresponding receiver output, with a precoder. Assume start bit as 1.
  - Suppose that due to error during transmission the level at the receiver input produced by the second digit is reduced to zero. Construct the new receiver output.
  - Repeat the above two cases with the use of a precoder ( Assume start bit as 1). (12 Marks)
- 7 a. Describe the operation of DPCM transmitter and receiver using relevant block diagrams. (08 Marks)
- b. Describe the operation of delta modulation transmitter and receiver, using relevant block diagrams. Also describe briefly the error encountered in Dm and the methods to overcome the same. (12 Marks)
- 8 Write short notes on the following:
- Digital Hierarchy, bell system.
  - Power Spectra of NRZ unipolar format.
  - Adaptive Equalization.
  - Eye diagram. (20 Marks)

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