Ref. No. Ex / CSE / T / 226 / 81 / 2011

BCSE 2ND YEAR 2ND SEMESTER EXAMINATION 2011

DATA COMMUNICATION SYSTEMS

Time: Three Hours Full Marks 100

Answer question no. 1 and any 4 questions from the rest.

1. Answer any 10 questions:
(i) Explain odd symmetry and half-wave symmetry.
(ii) What is the effect of non-linear mixing on single input frequency.
(iii) What are the two broad categories of noise? Explain with examples.
(iv) What are the advantages of DPCM over PCM?
(v) What is Amplitude Shift Keying ? What are the problems with Amplitude Shift Keying?
(vi) Define signal-to-noise ratio.
(vii) What is bandwidth of a signal?
(viii) With a diagram show the construction of a coaxial cable.
(ix) What are DTE and DCE? Give example of each.
(x) What are the different types of specifications needed for an interface between a DTE and a DCE?
(xi) What is radio horizon?
(xii) What is a null modem?

2x10=20

1. (a) Discuss linear and non-linear mixing. Explain the effects of linear and non-linear mixing on more than one input signals.
(b) Describe the relationship among *thermal noise power*, *bandwidth* and *temperature*. If an amplifier has a bandwidth B = 25 kHz and a total noise power $N = 2 \times 10^{-17}$ W, determine the total noise power (i) if the bandwidth increases to 50 kHz, and (ii) if the bandwidth decreases to 10 kHz.
(c) Define noise factor and noise figure. How do you compute noise figure for cascaded amplifiers?
Determine the noise factor and noise figure of an amplifier with an input signal-to-noise ratio of 30 dB and an output signal-to-noise ratio of 24 dB. Also determine the overall noise factor and noise figure when three such amplifiers are cascaded. The power gain of each amplifier is 20dB.

(2+3)+4+(4+3+4)=20

2. (a) How does signal propagate through fiber optic cable? Discuss the different modes of propagation though fiber optic cable.
(b) Write at least two applications of VLF, MF, HF and UHF radio waves.
(c) Why are the spread spectrum technologies used in data communication? Describe and contrast the two techniques of spread spectrum technologies: FHSS and DSSS.

(4+6)+4+6=20

3. (a) Explain how Geostationary satellites are used for data communication. What are the advantages of these satellites over MEO and LEO satellites?
(b) Briefly discuss frequency division multiplexing and time division multiplexing. Among the following techniques, which do you think is more efficient for irregular data flow and why: FDM, Synchronous TDM and Asynchronous TDM?
(c) Ten sources, seven with a bit rate of 250 kbps and three voice channels occupying bandwidth of 4 kHz are needed to travel on a synchronous TDM channel. The analog signals are sampled at the Nyquist rate. The digitizing error is to be held below 0.2%. Each output slot carries 1 byte from each source and one extra bit is added for synchronization. Answer the following questions:

(i) What is size of an output frame in bits?
(ii) What is the output frame rate?
(iii) What is the duration of an output frame?
(iv) What is the data rate required for the channel?

(4+3)+(4+2)+7=20

4. (a) A direct sequence spread spectrum transmitter uses BPSK encoding to transmit the data bits on an analog line. A pseudorandom bit stream 1001 0110 1001 0100 1010 1100 1011 0110 is being used for spreading the spectrum. Draw the analog waveform that will be generated for transmitting the data stream 10111001.
Also draw the waveform if the transmitter uses QPSK encoding.
(b) Describe the three problems in digital-to-digital encoding. Discuss how synchronisation problem is handled in RZ, Manchester and Differential Manchester schemes of digital-to-digital encoding.

8+(6+6)=20

5. (a) Discuss amplitude modulation technique. Show that the bandwidth required for AM signal is twice the frequency of the modulating signal.
(b) Name the different techniques for digital to analog conversion and give an example of each.
A V.32 modem uses 32-QAM encoding and trellis-coded modulation (one extra bit for error checking). The modem works in full-duplex mode on a 4-wire leased line. The line bandwidth used by the modem is 2400 Hz. Calculate the minimum time required by the modem to download one million bytes of information.
(c) State Sampling theorem. What is Nyquist rate?

(3+4)+(4+6)+3=20

6. (a) What is Hamming distance?
Using geometric concept show that in order to detect up to s errors, the minimum Hamming distance in a block code must be greater than s.
What must be the minimum Hamming distance required for error correction in a code word corrupted by errors in t bits or less?
(b) A Hamming code word is received as 00010111110. Odd parity is used. Locate and correct the bit in error.
(c) What is the importance of flow control? Briefly discuss the Sliding Window mechanism for flow control. Comment of the link utilization by sliding window protocol.

(2+3+3)+4+(2+4+2)=20