EX/CSE/T/226/78/2010

BACHELOR OF COMPUTER SCEINCE & ENGG. EXAMINATION, 2010

(2nd Year, 2nd Semester,)

DATA COMMUNICATION SYSTEMS

Time: Three Hours Full Marks 100

Answer any 5 questions.

1. (a) What is wave symmetry? Describe different types of wave symmetries.

(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?

(d) Define (i) Nyquist bit rate, and (ii) Shannon capacity.

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

2. (a) Discuss the construction of coaxial cable. What are the different types of connectors in coaxial cable?

(b) What are the different types of propagation through unguided media?

(c) Discuss multimode step-index propagation in fibre optic cable. What is the problem with this type of propagation? How the problem is overcome in (i) multimode graded index, and (ii) single mode fibre optic cable?

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

3. (a) Describe and contrast frequency division multiplexing and time division multiplexing. Which do you think is more efficient for irregular data flow and why: FDM, Synchronous TDM and Asynchronous TDM.

(b) Ten sources, seven with a bit rate of 50 kbps and three with a bit rate of 46 kbps are to be combined using synchronous TDM. Each output time slot carries 1 bit from each digital source, and one extra bit is added to each frame for synchronization. Answer the following questions:

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

(c) Discuss the Frequency hopping spread spectrum technique. What are the purposes of using this technique?

(6+3)+6+5=20

4. (a) State Sampling theorem. What is Nyquist rate? Describe Differential Pulse Code Modulation technique for analog to digital encoding. What are the advantages and disadvantages of this technique in comparison with PCM technique?

(b) Ten analog signals that are bandlimited to frequencies below 16 kHz are sampled at the Nyquist rate. The digitizing error is to be held below 0.5%. The signals are to travel on a synchronous TDM channel. What is the data rate required for the channel?

(2+2+6+3)+7=20

5. (a) Describe the three problems in digital-to-digital encoding. Discuss how synchronisation problem is handled in AMI, B8ZS and HDB3 schemes of digital-to-digital encoding.
(b) Draw the constellation diagram for the following: (i) with peak amplitude values of 2 and 4, (ii) BPSK, with peak amplitude value of 3, (iii) 8-PSK, with peak amplitude value of 3, and (iv) 8-QAM, with peak amplitude values 1 and 3 and four different phases.
(c) A modem uses a 4-wired line and operates in full duplex mode. If the modem uses 16 QAM encoding technique, what will be the maximum bit rate of the modem?

(6+6)+6+2=20

6. (a) Discuss how redundancy is used for error correction and detection.
(b) What is hamming distance? What is minimum hamming distance?
(c) Discuss the error control mechanisms in sliding window protocol for data transmission.
(d) If the frame size is 960 bits on a satellite channel operating at 960 kbps, what is the maximum link utilisation for the following: (i) Stop-and-wait flow control, (ii) Sliding window flow control with window size 7, and (iii) Sliding window flow control with window size 255? Assume propagation delay of 270 ms.

4+3+8+5=20

7. (a) Describe a CRC generator and a CRC checker.
(b) What should be the structure of a good polynomial generator to guarantee the detection of single bit error?
(c) If the CRC code is 10100010111100 and the generating polynomial is $x^4+x^3+x^2+1$, check if there is any error in the code word.
(d) Discuss delta modulation technique for analog to digital conversion. What are the different types of errors in delta modulation? How they are related to the parameter delta?
(e) Briefly describe amplitude modulation and frequency modulation techniques.

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