

BACHELOR OF COMPUTER Sc. ENGINEERING EXAMINATION 2009

(Second Year, Second Semester)

DATA COMMUNICATION SYSTEMS

Time : Three hours

Full Marks : 100

Answer any Four Questions.

1. (a) Briefly describe the difference between analog and digital signal. What is a periodic signal? Describe the different types of wave symmetries.
- (b) What is the significance of Fourier analysis? Define frequency spectrum and bandwidth.
- (c) What is thermal noise? Determine the thermal noise in watts and dBm for an electronic device operating at 28°C with a bandwidth of 100MHz. If the device operates with a signal power of 100 W, determine the signal-to-noise-power ratio in absolute and dB values.
- (d) When a communication system is considered to be effective? Give a brief overview of a typical communication system.
- (e) Describe the construction of any two guided transmission media. How effect of noise is controlled in these media?

$$(2+2+3)+(3+2)+(1+2+2)+3+(3+2)=25$$

2. (a) Using Shannon's formula determine the information capacity in bps for a circuit with 100 kHz bandwidth and a signal-to-noise ratio of 40 dB.
- (b) Discuss the different digital to analog modulation schemes.
- (c) A device has a bit rate of 2400 bps. What is the minimum bandwidth and baud rate if the device works with the following modulation schemes: (i) ASK, (ii) BPSK, (iii) QPSK, (iv) 16-PSK, (v) 8-QAM and (vi) 16-QAM.
- (d) Discuss Delta Modulation for analog to digital conversion. What are the advantages of Delta Modulation over PCM? What are the two types of noise in Delta Modulation? How are they related to the step size?

$$2+8+6+(4+2+2+1)=25$$

3. (a) Discuss the basic principle of signal propagation through fiber optic cable. Describe step-index and graded-index propagation through fiber optic cable.
- (b) Encode the following data streams using (a) RZ, (b) Manchester, (c) Differential Manchester, and (d) B8ZS encoding techniques.
- (i) 1010000110 (ii) 1000000001 (iii) 0101010101
- (c) Briefly describe the different phases of Pulse Code Modulation. A low pass signal with a bandwidth of 300 kHz has been sampled using 1024 levels of quantization. Calculate the bit rate of the digital signal.

$$(2+4)+12+(5+2)=25$$

4. (a) Describe a geosynchronous satellite. Discuss the advantages and disadvantages of geosynchronous satellites.

(b) Compare and contrast Frequency Hopping Spread Spectrum and Direct Sequence Spread Spectrum techniques.

(c) Discuss Time Division Multiplexing (both synchronous and asynchronous). What is the major disadvantage of synchronous Time Division Multiplexing? How is it overcome in asynchronous Time Division Multiplexing?

(d) A synchronous TDM system is used to transmit 24 voice-band channels. Each channel is sampled, and using 512 quantization levels each sample is converted to a PCM code. Determine the (i) minimum sampling rate and (ii) required line speed in bps.

What is the required line capacity if Frequency Division Multiplexing is used to combine the 24 voice-band channels?

$$(2+3)+5+(5+2+2)+(4+2)=25$$

5. (a) What is modem? Explain trellis-coded modulation technique.

A V.32 modem uses 32-QAM encoding and trellis-coded modulation. 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.

(b) What is the importance of flow control? Briefly discuss the Sliding Window mechanism for flow control. What is the significance of the term "Sliding Window"?

(c) If the frame size is 960 bits on a satellite channel operating at 960 bps, what is the maximum link utilization for Stop-and-Wait flow control mechanism? What is the maximum link utilization for Sliding Window flow control (i) with window size 7, and (ii) with window size 127?

Assume propagation delay of 270 ms.

$$(2+2+6)+(2+5+2)+(2+4)=25$$

6. (a) What is Hamming distance? What is minimum Hamming distance? Find the minimum Hamming distance of the coding scheme having codewords: 00000, 01011, 10101, 11110.

(b) To guarantee the detection of up to s errors in all cases, the minimum Hamming distance in a block code must be $s+1$. Explain the statement using geometric concept.

(c) Discuss how a CRC generator works.

(d) What are the different techniques for error control in Stop and Wait mechanism? Is there any problem in each of these techniques?

(e) What is a null modem? Discuss the purpose of using a null modem.

(f) What are DTE and DCE? What are the different types of specifications needed for an interface between a DTE and a DCE?

$$(1+1+2)+3+3+(5+2)+3+(2+3)=25$$