

Answer any 05 out of 06 Questions (Split answers are highly discouraged)

1. (a) Define Data Communication. Write the effectiveness of a data communications system according to fundamental characteristics. *extra 15 marks on slide 4, p-4(f)* 3
  - (b) For  $n$  devices in a network, what is the number of cable links required for a mesh, ring, bus, and star topology? *p-9 (f)* 2
  - (c) What are the responsibilities of physical and data link layer for a computer network? *slide 4, slide 3* 3
  - (d) Match the following to one or more layers of the OSI model:
    - i. Reliable process-to-process message delivery *slide*
    - ii. Route selection
    - iii. Defines frames
    - iv. Provides user services such as e-mail and file transfer
    - v. Transmission of bit stream across physical medium
    - vi. Error correction and retransmission *slide p-6(f)*
  - (e) Classify data flow with example. Suppose a computer sends a packet at the network layer to a computer somewhere in the Internet. The logical destination address of the packet is corrupted. What happens to the packet? How can the source computer be informed of the situation? *attached* 3
2. (a) Define the term bandwidth in two context: analog and digital. 2
  - (b) A nonperiodic composite signal has a bandwidth of 200 kHz, with a middle frequency of 140 kHz and peak amplitude of 20 V. The two extreme frequencies have an amplitude of 0. Draw the frequency domain of the signal. *p-88(f)* 2
  - (c) Define Transmission time and Propagation time. What are the propagation time and the transmission time for a 5-MB of an image if the bandwidth of the network is 1 Mbps? Assume that the distance between the sender and the receiver is 12,000 km and that light travels at  $2.4 \times 10^8$  m/s. *p-86 (f) Ex. 3.47* 4
  - (d) Illustrate Stop-and-Wait ARQ with Normal operation, lost frame and lost ACK. *80% 100% 5, 4*
  - (e) A file contains 2 million bytes. How long does it take to download this file using a 56-Kbps channel? 1-Mbps channel? *5 MB, 5, 6, 100%* 2
3. (a) Explain Polar biphase scheme with different coding criteria. *PRX polar, polar, bipolar* 4
  - (b) Discuss the different situations in HDB3 scrambling technique. *p-101* 3
  - (c) Compare and contrast PCM and DM. What are the steps in quantization of PCM? *153* 3
  - (d) What is the maximum data rate of a channel with a bandwidth of 200 KHz if we use four levels of digital signaling? *Performance better than 200 KHz* 2
  - (e) A network using CSMA/CD has a bandwidth of 10 Mbps. If the maximum propagation time (including the delays in the devices and ignoring the time needed to send a jamming signal, as we see later) is 25.6  $\mu$ s, what is the minimum size of the frame? 2

digital signal is a composite analog signal with

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Discuss QPSK and its implementation.

- We have an available bandwidth of 100 kHz which spans from 200 to 300 kHz. What should be the carrier frequency and the bit rate if we modulated our data by using PSK with  $d = 1$ ? 2
- (c) A corporation has a medium with a 1-MHz bandwidth (lowpass). The corporation needs to create 10 separate independent channels each capable of sending at least 10 Mbps. The company has decided to use QAM technology. What is the minimum number of bits per band for each channel? What is the number of points in the constellation diagram for each channel? Let  $d = 0$ . 2
- (d) Illustrate the CSMA/CA technique and its uses. 4
- (e) Fill in the blanks with appropriate answer. 3
- (i) In a \_\_\_\_\_ communication, the media is dedicated.
  - (ii) In fiber optics, the signal is \_\_\_\_\_ waves.
  - (iii) UTP and STP are different implementations of \_\_\_\_\_ cable.
  - (iv) Circuit switching is normally used in \_\_\_\_\_ layer.
  - (v) In the \_\_\_\_\_ random-access method, stations do not sense the medium.
  - (vi) In FDMA, we use different \_\_\_\_\_ to achieve channelization.

sf  $\frac{1}{T}$   
 $S = \frac{1}{T} \times \frac{1}{T}$

5. (a) The code 11110101101 was received. Show the original code using the Hamming encoding algorithm. 6
- (b) Discuss the steps involved in CRC technique. 6
- (c) Why two dimensional parity checks are used in data transmission? 2

6. (a) What kind of error is undetectable by the checksum? Show the steps of checksum for the given bit sequences 10111001 and 00110110. 7
- (b) Explain about bit padding and synchronizing in multiplexing systems. 4
- (c) Four 2-kbps connections are multiplexed together. Find (1) the duration of 1 bit before multiplexing (2) the transmission rate of the link (3) the duration of a time slot (4) the duration of a frame. 3



Patuakhali Science and Technology University

3<sup>rd</sup> Semester (L-2, S-1), Final Exam. of B. Sc. Engg. (CSE), January-June. 2015

Course Code: CCE-211

Course Title: Data Communication and Engineering

Credit Hour: 3.0

Full Marks: 70

Duration: 3 hours

[Figures in the right margin indicate full marks. Split answering of any question is not recommended]

Give the answers of any 5 questions from the given questions:

1. (a). How can a composite signal be decomposed into its individual frequencies? What are the differences between low pass and band-pass channel? 6
- (b). What is Nyquist bit rate? Why it is used in digital transmission? 6
- (c). Consider a noiseless channel with a bandwidth of 3000 hz transmitting a signal with eight signal level. Calculate the maximum bit rate. 2
2. (a). For the bit stream of 00101101110011, show the Manchester, bipolar and MLT-3 encoding. 6
- (b). Write down the short notes on (i) 8B/6T block codes (ii) PCM (iii) PAM (iv) 2B1Q 8
3. (a). What are the limitations of NRZ encoding? How these limitations can be solved? 4
- (b). Why 4-PSK method is more efficient than 2-PSK method? Compute the bit rate for a 1000 baud 32-QAM signal. 4
- (c). Draw the constellation diagram of 8 PSK, 8-QAM, 16-QAM. 6
4. (a). How is CDMA superior to TDMA and FDMA? 3
- (b). Show the multiplexing and de-multiplexing steps in CDMA technique. 8
- (c). What are the properties of orthogonal sequences? 3
5. (a). How the receiver confirms the error on the word "world"? 3
- (b). Why two-dimensional parity check bit is used? What are the limitations of parity check bit? 4
- (c). How CRC generator works for error detections? 7
6. (a). What are the purposes of using of hamming code in data transmission? 4
- (b). Show the error detection and correction technique using hamming code when the data 1001101 has been corrupted to 1000101. 10