B.Sc. Engineering Part-III Odd Semester 2021
Course: ICE 3151 (Communication Engineering)
Full Marks: 52.5   Time: 3 Hours
[Answer six (06) questions taking any three (03) from each section]

Section-A

1. (a) Suppose you are sending an image from your laptop to your friend's desktop through e-mail. Assume that email uses SMTP protocol and both of you are using the same network connected through UTP cable. Identify all the components of this communication system. Explain your answer. — 4
   (b) What are the different elements of a protocol? — 2
   (c) Define and differentiate the baseband and broadband transmission. — 2.75

2. (a) A signal is carrying data in which one data element is encoded as one signal element ($r=1$). If the bit rate is 100Kbps, what is the average value of the baud rate if c is between 0 and 1? — 2
   (b) Suppose a signal travels through a transmission medium and its power is reduced to one-half. Calculate the attenuation of that signal. — 2
   (c) What is noise? Explain different types of noise which corrupt the signal. — 2.75
   (d) Explain how 8B/10B block coding scheme can achieve error detection? — 2

3. (a) Draw the graph of the NRZ-I and Differential Manchester scheme for each of the following data streams, assuming that the last non-zero signal level was positive:
   (i) 11110011   (ii) 11000001   (iii) 01011000 — 3
   (b) What is the primary reason for using Multilevel line coding schemes? Explain the 2B1Q scheme with proper diagram. — 3.75
   (c) Define baseline wandering and its effect on digital communication. — 2

4. (a) What is the simplest analog to digital conversion technique? Explain this technique briefly. — 3.75
   (b) What is the maximum data rate of a channel with a bandwidth of 200 KHz if we use four levels of digital signaling? — 2
   (c) Suppose we have 9 sampled amplitudes as -6.1, 7.5, 16.2, 20, 11, -5.5, -20, -9.4 and -6 in PCM. We decide to have 8 quantization levels. Find the output encoded words (bit stream) after quantization by drawing necessary figures. — 3

Section-B

5. (a) Define carrier signal. Which characteristics of the carrier signal are changed in each of the following digital to analog conversion techniques: i) ASK   ii) FSK   iii) PSK   iv) QAM — 2
   (b) What is baud rate? What is the number of bits per baud for the following techniques? — 3
      i) ASK with four different amplitudes;   ii) FSK with eight different frequencies;
      iii) PSK with sixteen different phases;   iv) QAM with a constellation diagram of 128 points.
   (c) Explain the basic concepts of binary FSK and multilevel FSK. — 3.75

6. (a) Suppose we have disparity in the input data rates for TDM. Explain the strategies to manage this critical situation. — 2.75
   (b) We have four sources, each having 1Mbps data stream inputs. The unit of data is 1 bit. Then find i) the input bit duration, ii) the output bit duration, iii) the output bit rate, and iv) the output frame rate. — 4
   (c) Distinguish between synchronous and statistical TDM. — 2

7. (a) What is minimum hamming distance? If we want to be able to detect two-bit errors, what should be the minimum hamming distance? — 2.75
   (b) The most familiar error-detecting code is the parity-check code. Write short note on this code. — 3
   (c) Explain different types of propagation modes used in optical fiber. — 3

8. (a) What is satellite communication? What are the advantages of satellite communication? — 2
   (b) What is footprint? Show that the Bangabandhu-1 Satellite is geostationary considering its distance from earth surface as approximately 35,786km and the radius of the Earth as 6,378km. — 3.75
   (c) What type of propagation mode does satellite communication use? How does that mode differ from other propagation modes? — 3

University of Rajshahi
Department of Computer Science and Engineering
B.Sc. Engineering Part-3 Odd Semester Examination-2020
Course: ICE3151 (Communication Engineering)
Time: 3 Hours   Full Marks: 52.5
[Answer six (06) questions taking any three (03) from each Section]

Section-A

1. (a) What do you mean by data communication? Suppose you are downloading a   3.75
video file from a server machine to your desktop over a wired (UTP cable)
network using ftp service. Identify the components considering this as a
complete communication system.

(b) Explain different forms of data that could be transmitted using a data   3
communication system.

(c) Find the bit rate and bit duration for the following signal: 2

2. (a) A signal has a wavelength of 1 μm in air. How far can the front end of the   2
signal travel during 500 periods?

(b) If a periodic signal is decomposed into five sine waves with frequencies of 100,   2
300, 500, 700, and 900 Hz, what is its bandwidth? Draw the spectrum,
assuming all components have a maximum amplitude of 10 V.

(c) What is noise? Explain different types of noise that may corrupt the signal.   2.75

(d) Suppose a signal travels through a transmission medium and its power is   2
reduced to one-half. Calculate the attenuation of that signal.

3. (a) Draw the output digital signal encoded using NRZ-I and Differential   2
Manchester schemes for the data stream 00110011(last signal level was
positive).

(b) A signal is carrying data in which one data element is encoded as one signal   2
element (r = 1). If the bit rate is 100 kbps, what is the average value of the baud
rate if c is between 0 and 1?

(c) Define baseline wandering and its effect on digital communication.   2.75

(d) What are the transition rules used in MLT-3 scheme?   2

4. (a) What is multiplexing? Draw the basic format of a multiplexed system.   2

(b) Why addressing is necessary in statistical TDM?   2

(c) Why is empty slot in synchronous TDM? How it is removed in statistical   3
TDM?

(d) Explain ASK digital-to-analog modulation technique.   1.75

Section-B

5. (a) Define carrier signal and explain its role in analog transmission.   2.75

   (b) What is the required bandwidth for the following cases if we need to send 6000   3
   bps? Let d=1.(i) ASK, (ii) FSK with 2Δf = 4 KHz, and (iii) QPSK.

   (c) Draw the constellation diagram for the following cases. Find the peak   3
   amplitude value for each case and define the type of modulation (ASK, FSK,
   PSK or QAM). The numbers in parentheses define the values of I and Q
   respectively.
   - (i) Two points at (-4, 0) and (4, 0);
   - (ii) Two points at (5, 0) and (2, 0);
   - (iii) Four points at (2, 2), (-2, 2), (-2, -2) and (2, -2);
   - (iv) Two points at (0, 5) and (0, -5).

6. (a) What are the three major steps in block coding? How can block coding aid in   2.75
   synchronization?

   (b) What is quantization in PCM? What is the sampling rate for PCM if the   3
   frequency ranges from 1 to 4 KHz? What would be the bit rate if 8 bits/sample
   are used?

   (c) Compare the two methods of serial transmission. Discuss the advantages and   3
   disadvantages of each.

7. (a) Explain different ways in which unguided signals can travel.   3
   (b) What is Infrared wave? Mention some of its characteristics and applications.   2.75
   (c) Explain the principle that fiber-optic cable use to transmit data.   3

8. (a) What is footprint? Show that the Bangabandhu-1 Satellite is geostationary   3.75
   considering its distance from earth surface as approximately 35,786 km and the
   radius of the Earth as 6,378 km.

   (b) What do you mean by error detection and error correction?   2
   (c) What is the minimum Hamming distance? If we want to able to detect two-bit   3
   errors, what should be the minimum Hamming distance?

University of Rajshahi
Department of Computer Science and Engineering
B.Sc. Engg. Part-3 Odd Semester 2019
Course: ICE3151 (Communication Engineering)
Time: 3 Hours   [Answer any three (03) questions from each Section.]   Full Marks: 52.5

Section-A

1. (a) What is meant by data communication? Explain all the basic components used in a data communication system.   4

   (b) Explain half-duplex and full-duplex data transmission with appropriate examples.   2

   (c) How does digital signal differ from analog signal? A signal has been received that only has values of -1, 0 and 1. What types of signal they are? Draw the signals.   2.75

2. (a) We send a digital signal from one PC on a LAN to another PC. Is this baseband or broadband transmission?   1.75

   (b) How many bits can fit on a link with a 2 ms delay if the bandwidth is i) 1Mbps ii) 100 Mbps?   2

   (c) The attenuation of a signal is -10 dB. What is the final power if it was originally 10 W?   2

   (d) A network actually sends 12000 frames per minute with each carrying an average of 10000 bits. The throughput of the network is one-fifth of the bandwidth. What is the bandwidth of the network?   3

3. (a) Draw the digital signals encoded using NRZ-L and NRZ-I for the bit stream 11100010. Mention the problems occurred for this bit combination with each technique. (Last non-zero signal level has been positive.)   3.75

   (b) Define baseline wandering and mention its effect on digital transmission.   2

   (c) Draw the resulted signal of scrambling the sequence 11000000000001 using B8ZS and HDB3 scrambling techniques. (Last non-zero signal level has been positive.)   3

4. (a) Define block coding and give its purposes. The input stream to a 4B/5B block encoder is 0100 0000 0000 0000 0000 0001. What is the length of the longest consecutive sequence of 0s in the input and output of the encoder?   3

   (b) Name and distinguish between the three different techniques in serial transmission.   3

   (c) What is the purpose of pulse code modulation (PCM)? Explain its quantization step in brief.   2.75

Section-B

5. (a) Define carrier signal and explain its role in analog transmission.   2.75

   (b) Calculate the baud rate for the given bit rate and type of modulation   3
      i) 4000 bps, QPSK,   ii) 3000 bps, FSK,   iii) 36000 bps, 64-QAM

   (c) Define constellation diagram. Draw the constellation diagram for the following: 3
      i) ASK with peak amplitude values of 1 and 3;
      ii) BPSK with peak amplitude value of 2;
      iii) QPSK with peak amplitude value of 3; and
      iv) 8-QAM with two peak amplitude values of 1 and 3 and four different phases.

6. (a) What are the goals of multiplexing?   2

(b) We need to use synchronous TDM and combine 40 digital sources, each of 100 Kbps. Each   3
output slot carries 1 bit from each source, but one extra bit is added to each frame for
synchronization. Answer the following questions:
    i) What is the size of the output frame in bits?
    ii) What is the output frame rate?
    iii) What is the output data rate?

(c) Four channels, two with a bit rate of 300 Kbps and two with a bit rate of 150 Kbps, are to be   2
multiplexed using synchronous TDM. How the disparity in the input data rates can be
handled?

(d) Why addressing is necessary in statistical TDM?   1.75

7. (a) Why error correction is more difficult than detection?   1.75

(b) Given the dataword 10011 and the divisor 1011. Generate the CRC codeword at the sender   4
side. Show how a single bit error can be detected at the receiver side.

(c) What is the purpose of cladding in an optical fiber? Calculate the bandwidth of the light   3
propagating trough optical fiber for the following wavelength ranges (assume the propagation
speed of optical fiber 2×10^8 m):
    i) 1000 to 1200 nm   ii) 1000 to 1400 nm

8. (a) What is satellite communication? What do you know about satellite orbits?   2

(b) What is a VSAT? What are the uses and characteristics of VSAT?   4

(c) Describe the GEO satellite.   2.75

Answer Six questions taking any Three questions from each section

Section - A

1. a) Define analog and digital data. — 2
   b) What do you mean by Frequency spectrum and Bandwidth? — 3
   c) A digital signal has a bit rate of 2000 bps. What is the duration of each bit (bit interval)? — 1.75
   d) Define Nyquist Bit Rate and Shannon Capacity. — 2

2. a) Consider a noiseless channel with a bandwidth of 3000 Hz transmitting a signal with two signal levels. What is the maximum bit rate? — 2.75
   b) We have a channel with a 1MHz bandwidth. The SNR for this channel is 63; what is the appropriate bit rate and signal level? — 3
   c) Discuss various types of transmission impairment. — 3

3. a) Assume a data stream is 10001110. Encode this stream, using the following encoding schemes — 7
      i. Unipolar
      ii. NRZ-L
      iii. NRZ-1
      iv. RZ
      v. Manchester
      vi. Differential Manchester
      vii. AMI
   b) What is the sampling rate for PCM if the frequency ranges from 1000 to 4000 Hz? — 1.75

4. a) Discuss Asynchronous and Synchronous transmission with their advantages and disadvantages. — 4.75
   b) What do you mean by modulation? What is the role of carrier signal? — 2
   c) Discuss briefly about Amplitude Shift Keying. — 2

Section- B

5. a) Among the following three tasks, which one is the most important for a data communication system and why? — 2.75
      i. Deliver data to the correct destination
      ii. Deliver data accurately
      iii. Deliver data in a timely manner
   b) What do you mean by a composite signal? Is it possible to represent a composite signal as a combination of simple sine waves? — 2
   c) What do you know about the following noises — 4
      i. Thermal noise
      ii. Induced noise
      iii. Crosstalk
      iv. Impulse noise

6. a) Discuss about Phase Shift Keying (PSK). — 2.75
   b) Discuss Quadrature Amplitude Modulation (QAM). — 3
   c) Differentiate between Pulse Frequency Modulation (PFM) and Pulse Time Modulation (PTM). — 3

7. a) Why do we need multiplexing in data communication? — 2
   b) Discuss about Frequency-division multiplexing (FDM). — 3.75
   c) Discuss Interleaving process of TDM briefly. — 3

8. a) What are the advantages of Satellite Communication? — 1
   b) According to Kepler's law, what is the period of a satellite that is located at an orbit approximately 35786 km above the earth? — 2.75
   c) Describe various categories of Satellites. — 5