

**[N.B. Answer FOUR questions taking at least TWO from each Section.]**

**SECTION A**

- 1.(a) Define Data. There exist five components of data communication- what are they? 2
- (b) Data flow techniques can be classified into three classes: simplex, half-duplex, and full duplex. Can you please explain those? 2
- (c) "A network must be able to meet a certain number of criteria. " – what are the criteria? 2
- (d) "Phase describes the position of the waveform relative to time 0" – can you please enlighten this statement? 2½
- 2.(a) In the context of composite signal, define the term Bandwidth. Assume that a composite signal contains frequencies ranging from 2000 to 6000 Hz. Please provide the frequency domain representation of the bandwidth spectrum for both periodic and non-periodic signals. 2½
- (b) Explain your idea about the time and frequency domain representation. Draw a sine wave in the time domain with a peak amplitude of 5V and frequency of 6 Hz. Represent the same information in the frequency domain. 2
- (c) How the Signal-to-noise (SNR) is defined? What do you think, which one is better in the context of transmission: high or low SNR? 2
- (d) Please explain the Alternate Mark Inversion (AMI) scheme as a bipolar technique. 2
- 3.(a) We can have two versions of polar NRZ: NRZ-L (NRZ-Level) and NRZ-I (NRZ-Invert). Assume that we are willing to send 01001110. Give us the illustrative representation for both NRZ-L and NRZ-I schemes. 2
- (b) We know serial transmission could be asynchronous, synchronous, or isochronous. Can differentiate asynchronous and synchronous transmission? 2
- (c) "There are three sampling methods"— what are they? Explain with necessary figures. 2½
- (d) Define carrier signal. In the Amplitude Shift Keying technique how the carrier signal is modified to transmit digital data? 2

**SECTION B**

- 4.(a) "We can divide TDM into two different schemes: synchronous and statistical" –what do you know about the statistical scheme? 2
- (b) "Multiplexing is the set of techniques that allow the simultaneous transmission of multiple signals across a single data link." – can you explain the set of techniques? 2½
- (c) Illuminate the idea of the Direct Sequence Spread Spectrum (DSSS) mechanism. 3

5.(a)	Define BPSK and DPSK.	2
(b)	Explain the generation and detection of binary PSK. Also derive the probability of error for PSK.	5½
(c)	Write the special features of QAM.	1
6. (a)	Explain various types of fiber optic cables used in the industry.	2½
(b)	Discuss different mode of radio wave propagation.	3
(c)	What are the different applications of satellite systems?	2
(d)	What is photo detectors?	1

**University of Rajshahi**  
**Department of Computer Science and Engineering**  
**B.Sc. Engineering Part-3 Odd Semester Examination-2022**  
**Course Code: ICE3161 Course Title: Communication Engineering**  
**Full Marks: 35 Time: 2:00 Hours**

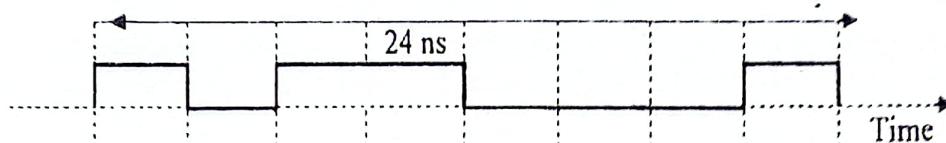
**[Answer 04 (Four) questions taking any 02 (Two) questions from each section]**

**Section-A**

1. (a) What do you mean by data communication? Suppose you are downloading a 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. 3.75

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

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



2. (a) The simplest way to represent a digital signal is by encoding a 1 as a positive voltage and a 0 as a zero voltage. However, a digital signal can have more than two levels. Can you elaborate on such a representation scheme? 3

- (b) What is the bit rate? Calculate the bit rate for a full HD TV (FHD TV). Given that the resolution of an FHD TV is 1920 by 1080 and the screen is renewing 30 times per second. The TV uses twenty-four bits to represent one color pixel and the weather condition is cloudy. 1.75

- (c) In the context of digital signal, what is meant by the term 'baseband transmission'? 1

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

- (e) Data rate depends on three factors' – what are they? 1

3. (a) 'The idea of RZ (transition at the middle of the bit) and the idea of NRZ-L are combined into the Manchester scheme' – can you explain the scheme? 3

- (b) 'We are looking for a technique that does not increase the number of bits and does provide synchronization and we are also looking for a solution that substitutes long zero-level pulses with a combination of other levels to provide synchronization.' – what could be the solution? 1

- (c) Bipolar with 8-zero substitution (B8ZS) is a Scrambling technique. Can you explain its mechanism of substituting eight consecutive zeros? 2.75

- (d) Please explain your idea on a data element and a signal element. 2

**Section-B**

4. (a) Have you heard the term Frequency Hopping Spread Spectrum (FHSS)? Explain its purpose and working principle. 3.75

- (b) 'In frequency shift keying, the frequency of the carrier signal is varied to represent data' – how is it done? 2

- (c) 'We can divide TDM into two different schemes: synchronous and statistical.' - can you explain the synchronous one? 3
5. (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
6. (a) "The correction of errors is more difficult than the detection" – explain, please. 2.75
- (b) Explain the basic idea of Block coding as a technique of error detection. 4
- (c) Assume that the given dataword is 1001 (i.e.  $k = 4$ ), the length of the codeword is 7 (i.e.  $n = 7$ ) and the shared divisor is 1011. What would be the codeword if the scheme is CRC? 2.75
- (d) Let us assume that a receiver received 10101001111 codeword encoded with the Hamming code technique. The received data has a single-bit error. Find the error and correct it. 4

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
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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: 3
- (i) 11110011 (ii) 11000001 (iii) 01011000
- (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

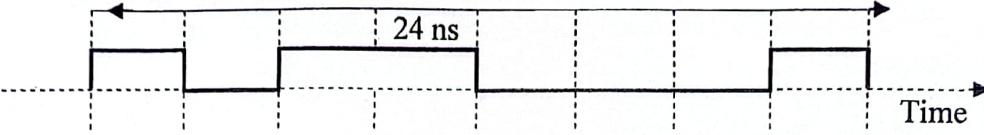
Section-B

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

X

**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 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. 3.75
- (b) Explain different forms of data that could be transmitted using a data communication system. 3
- (c) Find the bit rate and bit duration for the following signal: 2
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2. (a) A signal has a wavelength of  $1 \mu\text{m}$  in air. How far can the front end of the signal travel during 500 periods? 2
- (b) If a periodic signal is decomposed into five sine waves with frequencies of 100, 300, 500, 700, and 900 Hz, what is its bandwidth? Draw the spectrum, assuming all components have a maximum amplitude of 10 V. 2
- (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 reduced to one-half. Calculate the attenuation of that signal. 2
3. (a) Draw the output digital signal encoded using NRZ-I and Differential Manchester schemes for the data stream 00110011(last signal level was positive). 2
- (b) A signal is carrying data in which one data element is encoded as one signal 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? 2
- (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 TDM? 3
- (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 bps? Let  $d=1$ . (i) ASK, (ii) FSK with  $2\Delta f = 4$  KHz, and (iii) QPSK. 3  
(c) Draw the constellation diagram for the following cases. Find the peak 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 synchronization? 2.75  
(b) What is quantization in PCM? What is the sampling rate for PCM if the frequency ranges from 1 to 4 KHz? What would be the bit rate if 8 bits/sample are used? 3  
(c) Compare the two methods of serial transmission. Discuss the advantages and disadvantages of each. 3
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 considering its distance from earth surface as approximately 35,786 km and the radius of the Earth as 6,378 km. 3.75  
(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 errors, what should be the minimum Hamming distance? 3