MAKERERE UNIVERSITY

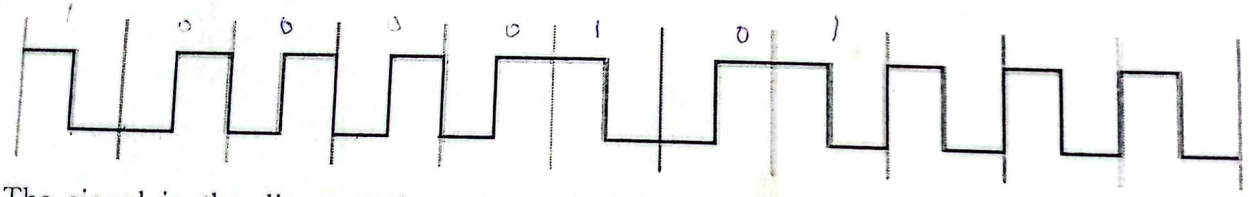
SCHOOL OF COMPUTING AND INFORMATICS TECHNOLOGY

Test - Data Communications BSE 2206

TIME: 11:00am-12:10am on 19th April, 2023

INSTRUCTIONS: *Attempt all questions*: Total mark= 40

Time Allowed: One Hour and 10 Minutes

1. With aid of a diagram differentiate between the three types of transmission impairment in guided media. (3marks)
2. Give four differences between baseband transmission and broadband transmission. (4 marks)
3. Distinguish between a low-pass channel and a band-pass channel. (2 marks)
4. What is the length of a bit in a channel with a propagation speed of 2×10^8 m/s if the channel bandwidth is 100 Mbps? (3 marks)
5. What is the total delay (latency) for a frame of size 5 million bits that is being sent on a link with 10 routers each having a queuing time of 2 μs and a processing time of 1 μs given that the length of the link is 2000 Km, the speed of light inside the link is 2×10^8 m/s and the link has a bandwidth of 5 Mbps. (5 marks)
6. In a digital transmission, the receiver clock is 0.5 percent faster than the sender clock. How many extra bits per second does the receiver receive if the data rate is 4 kbps? How many if the data rate is 2 Mbps? (5 marks)
7. Give the difference between ground propagation and sky propagation. (2 marks)
8. What is data communication and mention the four fundamental characteristics of effective data communication? (4 marks)
9. The attenuation of a signal is -80 dB. What is the final signal power if it was originally 15W? (3marks)
10. 

The signal in the diagram above is a Differential Manchester. Decode the signal and encode the output bits using NRZ-L, Bipolar -AMI and Manchester **(9 marks)**

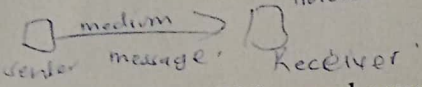
TEAM A TEST ONE

DATA COMMUNICATION

Question 1

a. What is data communication and mention the four fundamental characteristics of effective data communication? (3marks)

b. With aid of a diagram briefly explain the five components of a communication system (5marks)



c. The period of a signal 100ms and assume the speed of light is 3.0x108m/s. calculate the wavelength of the signal in cm (4marks)

d. A non-periodic composite signal has a bandwidth of 600kHz, with a middle frequency of 500 kHz and peak amplitude of 20V. the two extreme frequencies have an amplitude of 5v and 10v respectively. Draw the frequency domain of the signal. (7 marks)

e. Name any 3 types of transmission impairment in unguided media (3marks)

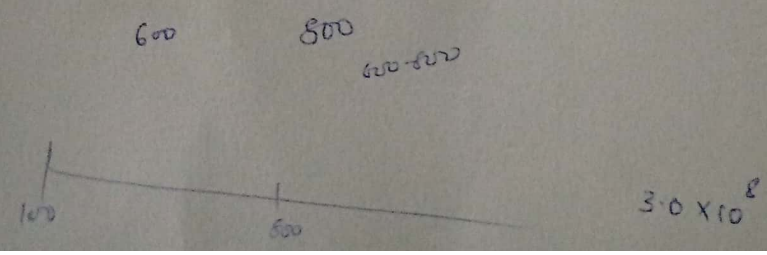
f. With aid of a diagram differentiate between the three types of transmission impairment in a guided media (3 marks)

Question 2

a. Using the 8-bit stream of (10011010) encode the following schemes respectively

i) Pseudoternary (5 marks)

ii) Manchester (5 marks)



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END OF SEMESTER II EXAMINATION 2022/2023

PROGRAMME: BSE & BCS

YEAR OF STUDY: II & III

COURSE NAME: DATA COMMUNICATIONS

COURSE CODE: BSE 2206

DATE: 31st May 2023 TIME: 12-3PM

EXAMINATION INSTRUCTIONS

1. ATTEMPT ALL QUESTIONS IN SECTION A (40 MARKS)
2. ATTEMPT THREE (03) QUESTIONS IN SECTION B (60 MARKS)
3. DO NOT OPEN THIS EXAM UNTIL YOU ARE TOLD TO DO SO
4. ALL ROUGH WORK SHOULD BE IN YOUR ANSWER BOOKLET

SECTION A [40 Marks] – Attempt All

a. Express the Nyquist sampling theorem. **(2 mark)**
b. Using Nyquist sampling theorem, sample a sine wave of 5Hz. **(2 marks)**
c. Differentiate between synchronous and asynchronous communication. **(2 marks)**
d. Differentiate between periodic and non-periodic signals. **(2 marks)**
e. Explain the concept of modulation and its relevance in communication systems. **(3 marks)**
f. Graphically, explain the concept of delta modulation. **(4 marks)**
g. By illustrating, what is the effect of the following in delta modulation **(4 marks)**
   1. Over sampling
   2. Under sampling
h. Illustrate and differentiate between the following
   1. simple periodic signal and a composite periodic signal **(2 marks)**
   2. Amplitude and frequency **(2 marks)**
   3. Wavelength and Period **(2 marks)**
   4. SNR and throughput **(2 marks)**
   5. Discrete signal and a continuous signal **(2 marks)**
i. Briefly illustrate the amplitude modulation process **(3 marks)**
j. What is the purpose of the carrier in the modulation process? **(2 marks)**
k. Briefly explain any four data communication quality of service parameters. **(4 marks)**
l. What is a cyclic redundancy check in communication systems? **(2 marks)**

SECTION B(60 MARKS) – ATTEMPT ONLY THREE QUESTIONS

Question One

a. Explain the concept of demodulation? **(2 Marks)**
b. Discuss the concept of differential modulation as used in communication systems? **(2 marks)**
c. Explain at least three differential modulation techniques you know. **(6 marks)**
d. Assume that a QPSK signal has the following phase offsets:
   $\frac{1}{2}\pi$ for 00, $\frac{1}{4}\pi$ for 01, $\frac{3}{4}\pi$ for 10, π for 11 and that the data stream is composed of the following 11101101101101100010. Draw the QPSK signal. **(6 marks)**
e. Identify any two pros and two cons of QPSK. **(4 marks)**

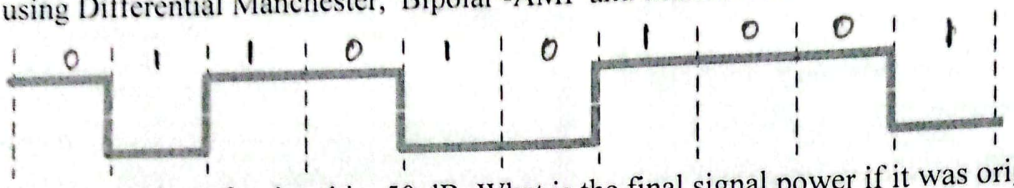
Question Two

a. How is fairness achieved in CSMA? Provide a detailed explanation. **(4 marks)**
b. By providing examples, differentiate between the following **(4 marks)**
   1. Consensus-based Time Synchronization MAC protocols

2. Hybrid MAC protocols

c. Discuss at least two likely challenges in consensus-based MAC protocols? **(2 marks)**

d. The signal in the diagram below is a NRZ-I. Decode the signal and encode the output bits using Differential Manchester, Bipolar -AMI and Manchester **(7marks)**



e. The attenuation of a signal is -50 dB. What is the final signal power if it was originally 5W? **(3marks)**

Question Three

a) The power from UMEME, they say, has a frequency of about 100 kHz. What is the period of the corresponding sine wave in μs? **(2 marks)**

b) A voice grade telephone line carries signals with frequencies ranging from 5100 MHz to 7500 MHz. Due to the thermal motion of atoms across the line, the temperature of the cables increases to 67°C. If the signal-to-noise ratio is 40dB, calculate

i. The theoretical channel capacity. **(5 marks)**

ii. The noise across this line. **(3 marks)**

c) A composite analog signal has three (3) simple signals with the following frequencies: Signal-1 (f = 3000 Hz), Signal-2 (f = 20 KHz), and Signal-3 (f = 3500 Hz). All signals have amplitude of 10 V.

i. If Signal-1 has a phase offset 45° and it is affected by distortion so its phase is shifted by ¾, graphically illustrate signal-1. **(4 marks)**

ii. Draw the frequency domain representation of the composite signal and find its bandwidth. **(3 marks)**

d) Explain any three types of transmission impairments in an unguided medium. **(3 marks)**

Question Four

a. Write brief notes about the following terms **(1mark@)**

i. Digitization

ii. Modulation rate

iii. Line coding

b. The initial SNR measured at a transmitter was 20 dB. In order to combat the channel conditions, the signal power was doubled prior to transmission. What is the new SNR at the transmitter? **(7 marks)**

c. State the most common technique used to change an analog signal to digital data and briefly explain the steps involved. **(6marks)**

d. Differentiate between uniform and non-uniform quantization.(Feel free to represent graphically) **(2 marks)**

e. A signal is carrying data in which 2 data elements are encoded as 3 signal elements. If the bit rate is 100 kbps, what is the average value of the signal rate if c is between **0** and **1**? **(2marks)**

Question Five

a. Differentiate between packet switching and circuit switching networks. **(3 marks)**

b. Characterize the ISDN architecture and VOIP in detail while comparing the two technologies. **(8 marks)**

c. SNR is a very important metric in Communication systems. Describe it. Is it desirable to have a high SNR for effective communication? **(2 marks)**

d. At a transmitter, the signal power is 23 mW. The input SNR is 40 dB. The channel offers 3 dB attenuation to the signal and the output noise is thrice the input noise level. Determine the SNR at the output. **(7 marks)**

End.