2602/305
DATA COMMUNICATION
AND NETWORKING
Oct./Nov. 2022
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING (TELECOMMUNICATION OPTION)

MODULE III

DATA COMMUNICATION AND NETWORKING

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Answer booklet;
Non-programmable scientific calculator;
Drawing instruments.
*This paper consists of **EIGHT** questions in **TWO** sections; **A** and **B**.*
*Answer **FIVE** questions, choosing at least **TWO** questions from each section in the answer booklet provided.*
All questions carry equal marks.
Maximum marks for each part of a question are as indicated.
Candidates should answer the questions in English.

This paper consists of 7 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

 Turn over

SECTION A: DATA COMMUNICATION

*Answer at least **TWO** questions from this section.*

1. (a) Define each of the following with respect to error coding:

(i) code word;
(ii) hamming code.

(2 marks)

(b) A (7,4) generator matrix is given as follows:

$$\tilde{G} = \begin{bmatrix} 110 & 1000 \\ 011 & 0100 \\ 101 & 0010 \\ 001 & 0001 \end{bmatrix}$$

(i) for the message 1111 and 1110 determine the code words.

(ii) obtain the parity check matrix, $\tilde{H}$

(8 marks)

(c) Draw a labelled block diagram of a pulse code modulation (PCM) transmitter and state the function of each block. (6 marks)

(d) A PCM system has an analogue signal whose maximum baseband frequency is 5 kHz. Each sample has 8-bits. Determine the:

(i) minimum sampling frequency;
(ii) bit rate.

(4 marks)

2. (a) With the aid of diagrams, describe each of the following data communication network:

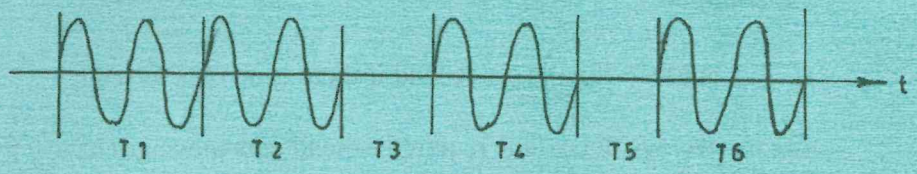
(i) multipoint;
(ii) distributed.

(6 marks)

(b) State **two** merits of serial data transmission mode. (2 marks)

(c) Figure 1 shows the waveforms of digital modulated data. Obtain the digital data streams in each case:

(i) ASK



(ii) PBSK

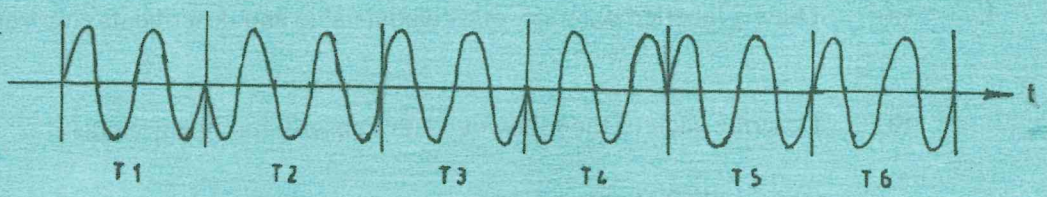


Fig. 1

(6 marks)

(d) For the bit stream: 100011011, draw waveforms for each of the following encoding schemes.

(i) Bipolar AMI;

(ii) Differential manchester.

(6 marks)

3. (a) With the aid of diagrams, describe each of the following switching methods:

(i) circuit switching;

(ii) datagram packet switching.

(8 marks)

(b) (i) With the aid of a flow-diagram, describe the stop-and-wait ARQ data link control protocol.

(ii) State the merit of the protocol in b(i).

(6 marks)

(c) A network connection operates in half-duplex mode. A poll and its response takes eight bytes. The network data rate is 9600 bps and the modem connection time its 8 mS. Determine the:

(i) number of polls per second if there is no data to send;

(ii) average delay time required to send data messages of 150 bytes from the cast of eight secondary stations to the primary stations.

(6 marks)

4. (a) Draw a labelled diagram, of a coaxial cable and describe its construction.

(6 marks)

(b) Describe each of the following data transmission impairments:

(i) attenuation;
(ii) jitter.

(4 marks)

(c) (i) With the aid of a diagram , describe Statistical Time Division Multiplexing (TDM)

(ii) State **two** merits of the TDM in c(i).

(8 marks)

(d) State **two** application areas of spread spectrum multiple access in data communication. (2 marks)

SECTION B: NETWORKING

*Answer at least **TWO** questions from this section.*

5. (a) For the high speed local area Network (LAN), state each of the following:

(i) **two** types of transmission media used;
(ii) data rate range;
(iii) access method.

(4 marks)

(b) Describe the defining features of the 100 BASE - T4 LAN. (6 marks)

(c) Figure 2 shows a diagram of a single-cell wireless LAN configuration.

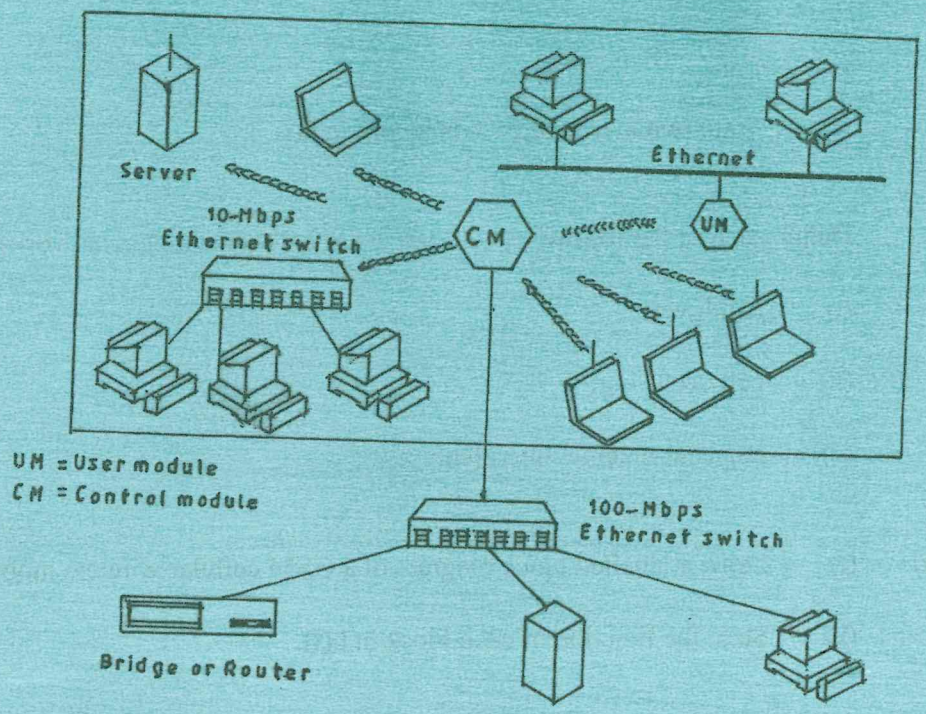


Fig.2

Explain the functions of each of the following components:

(i) CM;
(ii) UM;
(iii) Ethernet switch;
(iv) server.

(8 marks)

(d) State **two** demerits of wireless LANS. (2 marks)

6. (a) State **four** functions of the Communications Authority of Kenya (CAK). (4 marks)

(b) State **two** functions of each of the following OSI layers:

(i) data link;
(ii) transport;
(iii) physical.

(6 marks)

(c) (i) Using illustrations, describe each of the following Local Area Networks (LANS)

(I) Bus;
(II) Switched;

(ii) State **two** merits of each Network in c(i).

(10 marks)

7. (a) Define each of the following with respect to cellular wireless networks:

(i) handover;

(ii) cell-sectoring;

(iii) adjacent-channel intereference.

(3 marks)

(b) (i) Draw a labelled block diagram of a GSM cellular wireless mobile system.

(ii) State the function of each block in b(i).

(10 marks)

(c) A GSM cellular system has a total of 30 MHz of bandwidth. Each channel has an assigned bandwidth of 200 kHz. Each channel is divided into 8 time slots. Determine the:

(i) total number of radio channels;

(ii) maximum number of users.

(4 marks)

(d) State **three** merits of digital TV systems. (3 marks)

8. (a) Describe each of the following with respect to computer security:

(i) encryption;

(ii) public key;

(iii) phising attack.

(3 marks)

(b) Describe each of the following with respect to Wide Area Networks (WANs):

(i) Asynchronous Transfer Mode (ATM);

(ii) cable modem;

(iii) leased line.

(6 marks)

(c) (i) State **three** reasons for subnetting an IP network.

(ii) A network IP address is 192.168.10.0/224. Determine the

(I) subnet mask;
(II) number of subnets possible;
(III) first three host addresses in the first subnet.
(IV) broadcast address for the first subnet.

(11 marks)

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