

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.**



## 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:

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

- (i) for the message 1111 and 1110 determine the code words.
- (ii) obtain the parity check matrix,  $\bar{H}$

(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:

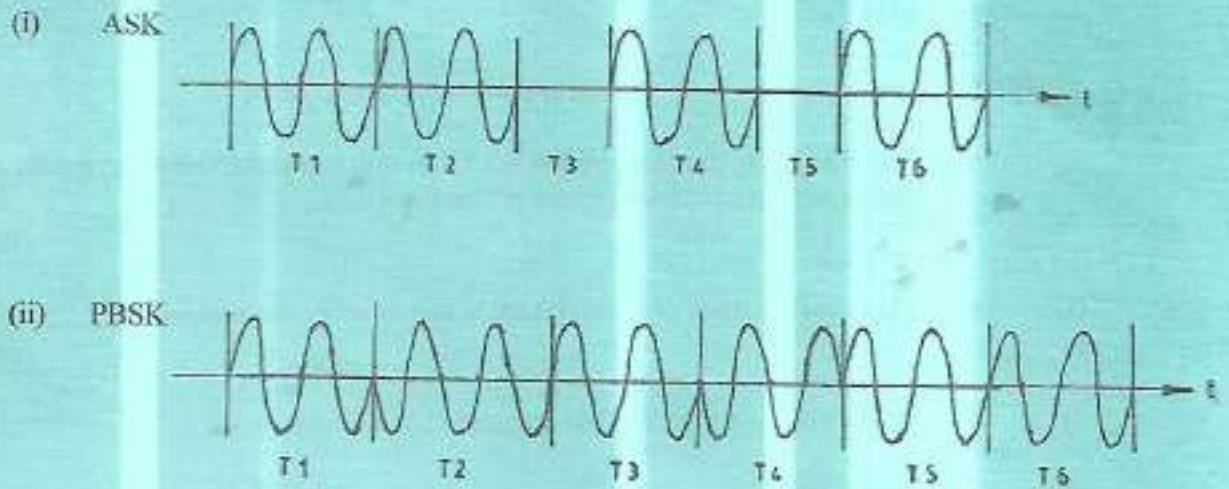


Fig.1

(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 is 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.

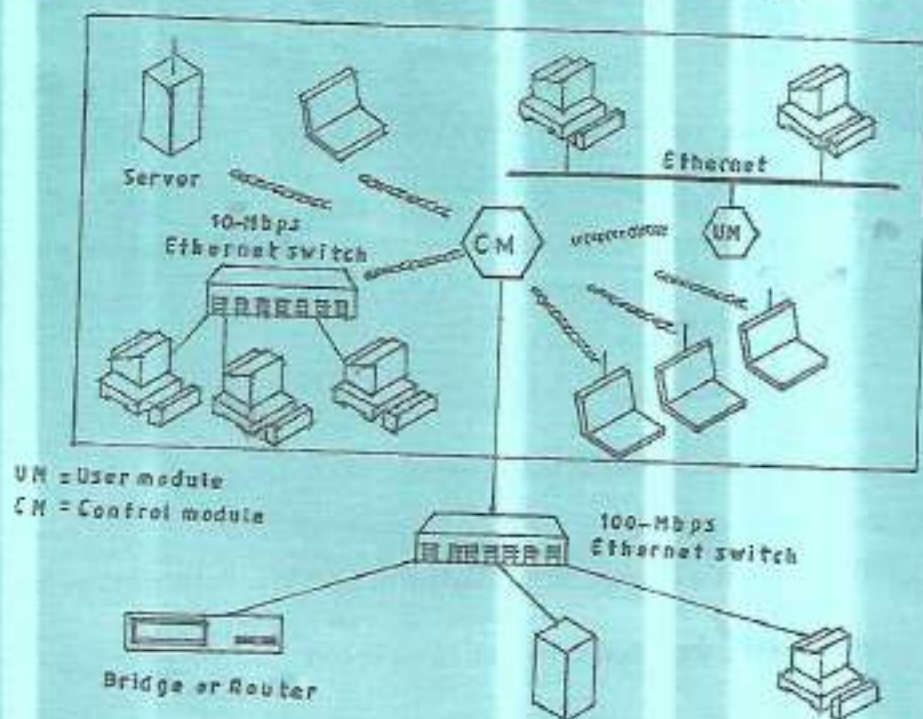


Fig.2

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 interference.

(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) phishing 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 192.168.10.0/24. 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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