

2506/306

2507/306

**DATA COMMUNICATION AND
COMPUTER NETWORKS**

June/July 2020

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
DIPLOMA IN AERONAUTICAL ENGINEERING
(AIRFRAMES AND ENGINES OPTION)
(AVIONICS OPTION)

MODULE III

DATA COMMUNICATION AND COMPUTER NETWORKS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Mathematical tables/Non programmable scientific calculator.

This paper consists of EIGHT questions.

Answer any FIVE questions 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 6 printed pages.

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

1. (a) Differentiate between serial and parallel data transmission citing **one** area of application for each. (4 marks)
- (b) Figure 1 shows a block diagram of a data communication system.
- (i) identify the components labelled X and Y;
- (ii) state the function of each block.

(6 marks)

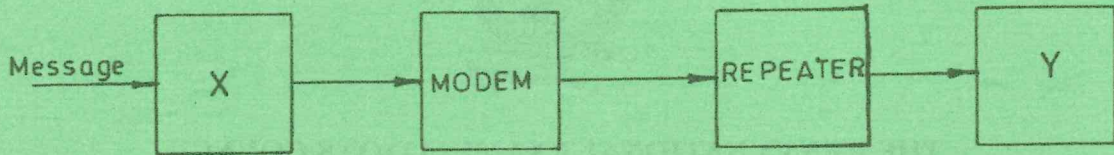


Fig. 1

- (c) (i) State **two** demerits of analogue signalling.
- (ii) The data pattern 11001011 is to be modulated. Draw the resultant waveforms for each of the following digital modulation schemes:

- (I) ASK;
- (II) FSK.

(8 marks)

- (d) Explain 'encapsulation' as used in peer to peer data communication. (2 marks)

2. (a) State **three** factors to be considered when choosing a line encoding scheme. (3 marks)

- (b) (i) With the aid of a diagram, describe the twisted pair cable.
- (ii) State **three** advantages of optic fiber-over-coaxial cables.

(9 marks)

(c) Figure 2 is a data waveform, encoded in differential manchester.

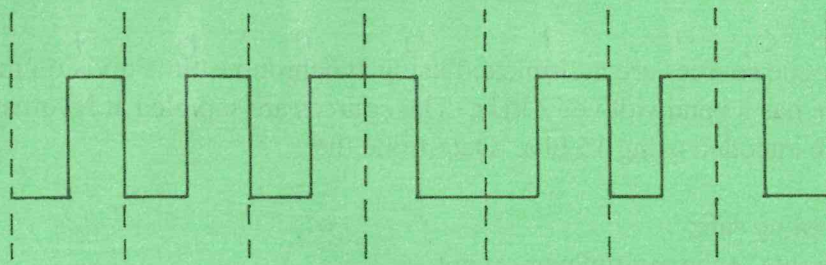


Fig.2

- (i) determine the data word in binary;
- (ii) encode the data in each of the following schemes:

- (I) bipolar AMI;
- (II) polar RZ.

(8 marks)

3. (a) State **three** types of losses in an optic fiber cable. (3 marks)
- (b) With the aid of a ray diagram and refractive index profile, describe signal propagation in a multi-mode graded index optic fiber cable. (7 marks)
- (c) Figure 3 shows a diagram of a data network.

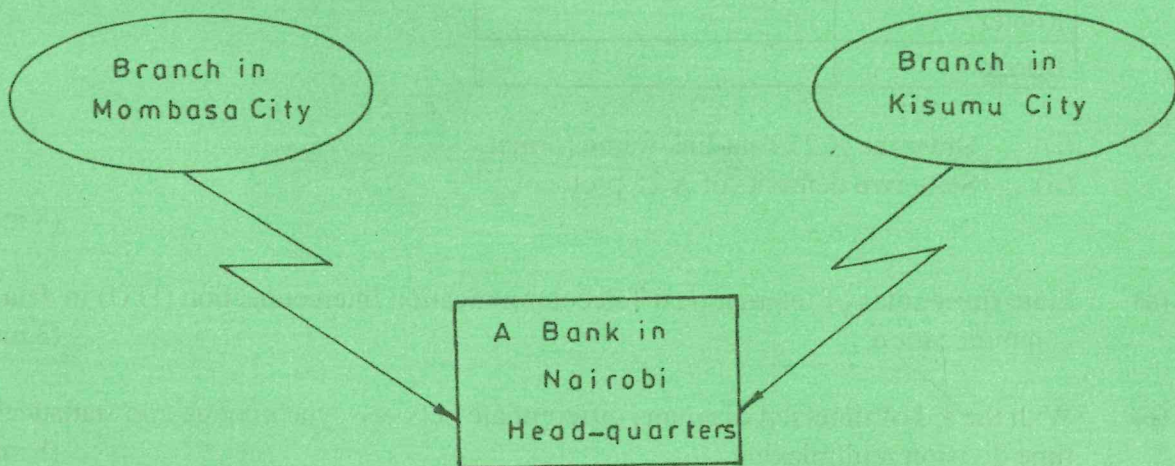


Fig. 3

- (i) identify the type of network;
- (ii) state **three** demerits of the network in (i).

(4 marks)

(d) Three analogue sources are multiplexed using synchronous time division multiplexing. Each source has a bandwidth of 2 kHz. The sources are sampled at Nyquist rate and each sample encoded using 15 bits. Determine the:

- (i) sampling rate;
- (ii) data rate at the multiplexer output.

(6 marks)

4. (a) Describe each of the following types of routing techniques:

- (i) centralised routing;
- (ii) adaptive routing.

(6 marks)

(b) List **two** application areas where flooding routing is most appropriate.

(2 marks)

(c) Table 1 shows different types of network devices and their corresponding layer of operation. Complete the table.

(4 marks)

Table 1

Network Device	OSI Layer
Gateway	
Repeater	
Router	
Bridge	

- (d) (i) Draw the X.25 data-link frame format.
- (ii) State **two** demerits of X.25 protocol.

(8 marks)

5. (a) State **three** roles of International Telecommunication Interconnection (ITU) in data communication.

(3 marks)

(b) With the aid of time-slot diagrams differentiate between synchronous-and statistical-time division multiplexing.

(8 marks)

(c) Figure 4 shows the layered diagram of the open system interconnection (OSI) model.

- (i) identify the layers labelled P, Q and R;
- (ii) state **two** functions for each of the layers P, Q and R.

(9 marks)

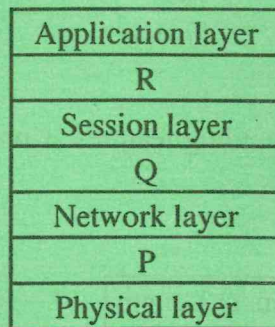


Fig. 4

6. (a) (i) Define each of the following with respect to error control:

- (I) code weight;
- (II) code distance.

(ii) State **two** types of errors which occur during data transmission.

(4 marks)

(b) Describe the Go-Back-N Automatic Repeat Request (ARQ) technique of error control.

(5 marks)

(c) Describe each of the following configurations with respect to virtual LANs:

- (i) manual configuration;
- (ii) automatic configuration;
- (iii) semi-automatic configuration.

(6 marks)

(d) (i) Table 2 shows different types of mobile network generations and their technologies. Complete the table:

Table 2

Technology	Mobile Network Generation
FDMA	
EDGE	
	3 rd Generation

(ii) State **two** characteristics of forward error control technique.

(5 marks)

7. (a) Describe **two** features of Transport Control Protocol (TCP) in data transmission. (4 marks)
- (b) (i) With the aid of a labelled diagram, describe virtual circuit packet switching technique.
(ii) State **three** merits of the technique in (i). (10 marks)
- (c) Table 3 shows ethernet protocols and their corresponding features. Complete the table. (6 marks)

Table 3

Protocol	Baseband (Mbps)	Maximum Segment Length (metres)
		500
100 Base X		
		200

8. (a) State **three**:
- (i) connectors used in LAN installations;
(ii) tools used in LAN installations. (6 marks)
- (b) Describe each of the following with respect to networking:
- (i) telecommunication closet;
(ii) backbone cable;
(iii) patch panel. (6 marks)
- (c) Table 4 shows symbols of the alphabet of a discrete memoryless source with their corresponding probabilities.

Table 4

Symbol	Probability
S_0	0.1
S_1	0.2
S_2	0.1
S_3	0.2
S_4	0.4

Determine the average code word length. (8 marks)

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