

2506/306
2507/306
DATA AND COMPUTER NETWORKS
Oct./Nov. 2022
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN AERONAUTICAL ENGINEERING
(AIRFRAMES AND ENGINES OPTION)
(AVIONICS OPTION)

MODULE III

DATA AND COMPUTER NETWORKS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

- answer booklet;*
- mathematical tables;*
- non-programmable scientific calculator;*
- drawing instruments.*

This paper consists of EIGHT questions.

Answer any FIVE of the EIGHT 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 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.

1. (a) With the aid of diagrams, describe each of the following data communication networks:
- point-to-point;
 - multipoint. (8 marks)
- (b) State **three** factors to consider when choosing a line encoding scheme. (3 marks)
- (c) **Figure 1** shows a waveform for a data word encoded using the Manchester encoding technique.

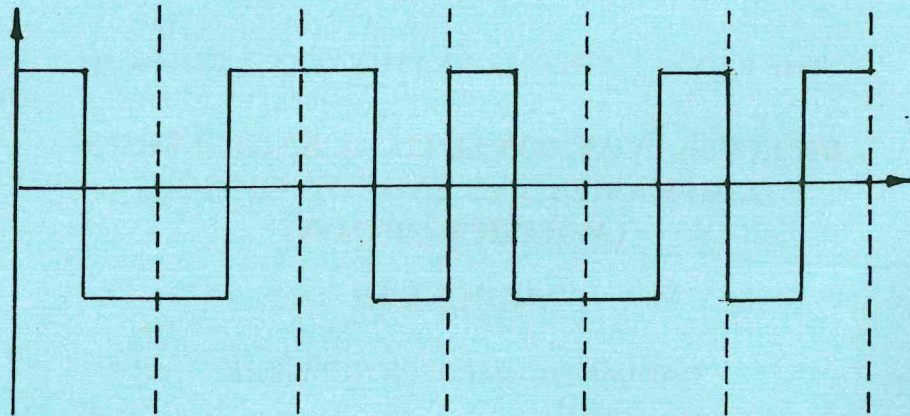


Fig. 1

- Decode the bit sequence in binary.
 - Draw the resultant waveforms for each of the following encoding schemes:
 - unipolar non-return to zero (NRZ);
 - bipolar AMI. (9 marks)
2. (a) Explain the function of each of the following elements of a pulse code modulator:
- low pass filter;
 - quantizer;
 - encoder. (6 marks)
- (b) In a pulse code modulation (PCM) system, a 5-bit encoder is used with each level representing 1 volt. Determine the:
- quantization levels;
 - range of the encoder;
 - maximum quantization error. (6 marks)



(c) With the aid of diagrams, describe each of the following time division multiplexing techniques:

- (i) statistical;
- (ii) synchronous.

(8 marks)

3. (a) **Figure 2** shows a layout diagram of a Local Area Network (LAN) topology.

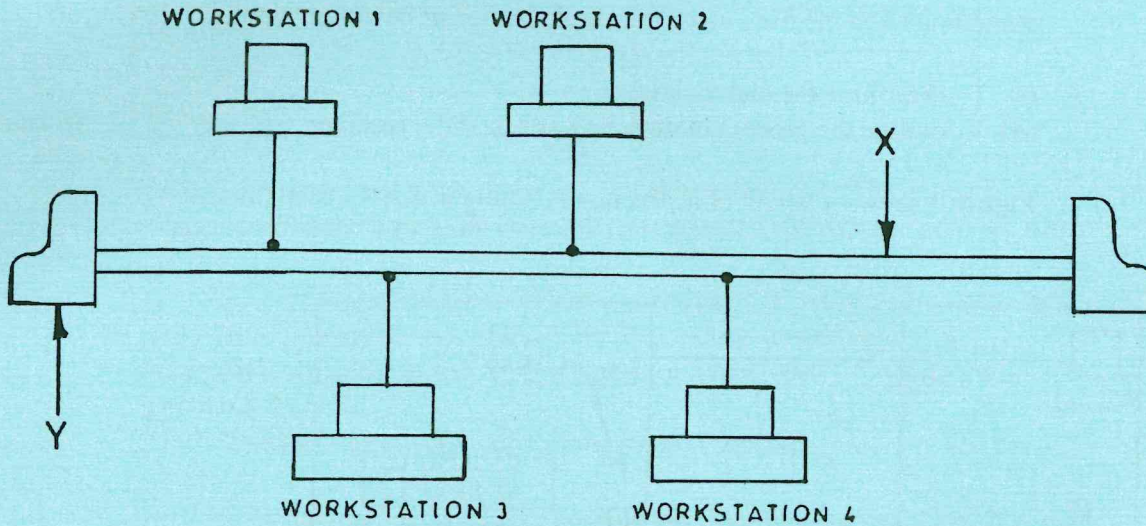


Fig. 2

- (i) Identify the topology.
- (ii) Identify the parts labeled X and Y, stating their function.
- (iii) Outline three demerits of this topology.

(8 marks)

(b) With the aid of a block diagram, describe the carrier sense multiple access with collision avoidance (CSMA/CA) protocol.

(6 marks)

(c) Using the following run length Encoded (RLE) sequence, reconstruct the original 2D, 8 x 8 (binary) data array.

(6 marks)

(0, 8)
 (0, 1), (1, 1), (0, 4), (1, 1), (0, 1)
 (0, 1), (1, 2), (0, 2), (1, 2), (0, 1)
 (0, 1), (1, 6), (0, 1)
 (0, 2), (1, 4), (0, 2)
 (0, 3), (1, 2), (0, 3)
 (0, 2), (1, 1), (0, 2), (1, 1), (0, 2)
 (0, 1), (1, 1), (0, 4), (1, 1), (0, 1)



4. (a) State the measures that may be taken to prevent each of the following data transmission impairments:

- (i) cross talk;
- (ii) echo;
- (iii) attenuation.

(3 marks)

- (b) A data word 10011001, 11100010, 00100100, 10000100 is transmitted in a communication medium using the check sum error detection method:

- (i) determine the checksum;
- (ii) outline the process of detecting errors at the receiver.

(6 marks)

- (c) **Figure 3** shows a layout of a structured cabling in LAN installation:

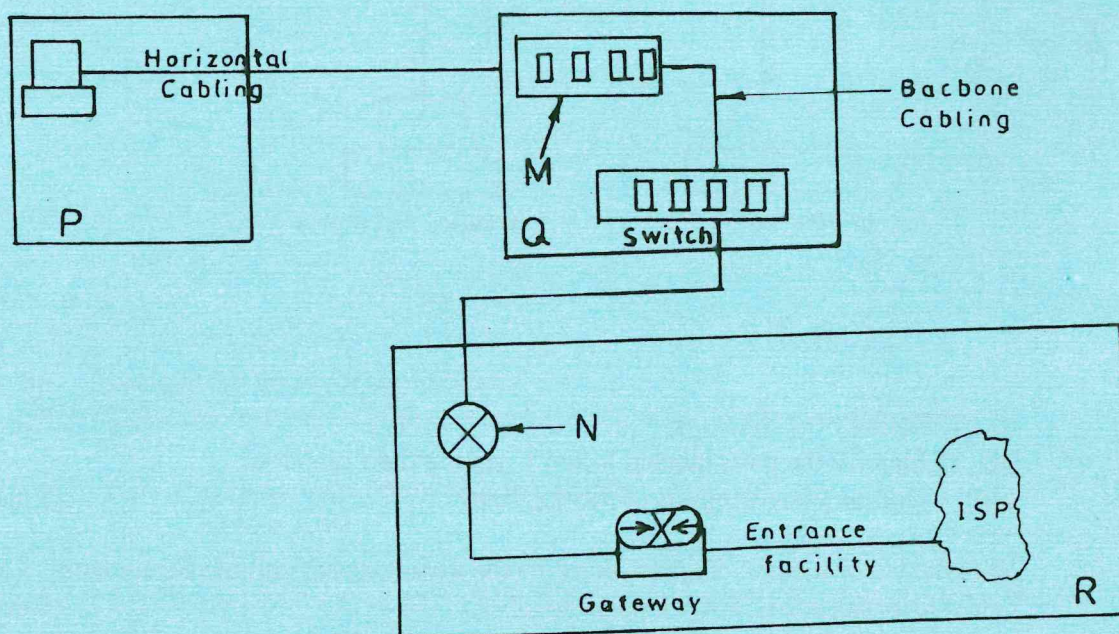


Fig.3

- (i) Identify the blocks labelled P, Q and R.
- (ii) Name the devices labelled M and N, stating their function in the network.
- (iii) State **two** functions of the Internet service provider (ISP).
- (iv) Identify the open system interconnection (OSI) layers in which the device labelled N and the switch operate.

(11 marks)



5. (a) State **four** advantages of virtual LANS over traditional LANS. (4 marks)
- (b) Table 1 shows different types of ethernet networks with their corresponding transmission media and maximum segment length. Complete the table. (6 marks)

Table 1

TYPE OF ETHERNET	MEDIA	MAXIMUM SEGMENT LENGTH
10 base T		
10 base F		
10 base 5		

- (c) (i) An Airline company has established a local area network. The network administrator has recorded the following issues experienced by some of the network users:

- I. PC 2 displaying the error message: "IP address already in use".
- II. Applications in PC 3 are responding very slowly.
- III. Unable to get an IP address for a new user.

State **two** reasons for each of the issues recorded.

- (ii) State **four** network troubleshooting applications that the network administrator can use in troubleshooting the network. (10 marks)

6. (a) **Table 2** shows OSI layers and functions, complete the table by matching each layer with its corresponding function. (5 marks)

Table 2

OSI layer	Function
Transport	File access, transfer and management
Physical	End to end delivery between hosts
Presentation	Establish, manage and terminate connection between application
Application	Line configuration
Session	Encryption and decryption of data

- (b) (i) With the aid of a diagram, describe the operation of token passing medium access control protocol in ring networks.
- (ii) State **two** limitations of the ring topology. (7 marks)
- (c) (i) Describe the three phases of a circuit switched data network.
- (ii) State **two** demerits of circuit switching. (8 marks)



7. (a) Distinguish between data terminal equipment (DTE) and data communication equipment (DCE), stating one example in each case. (4 marks)
- (b) With the aid of a labelled diagram, describe the Go-Back-N automatic repeat request (ARQ) flow control technique. (8 marks)
- (c) (i) **Figure 4** shows a cross section of an optical fibre cable.

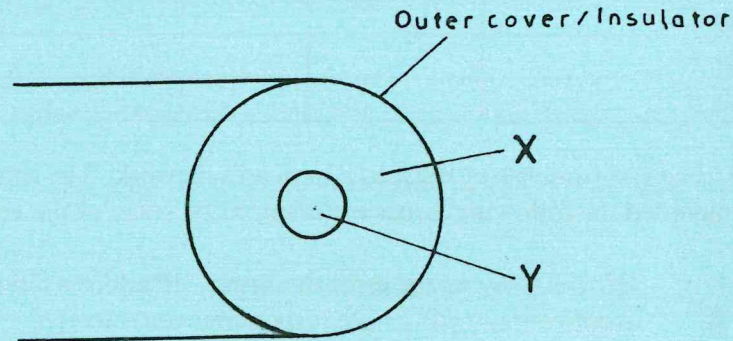


Fig. 4

Identify the parts labelled X and Y.

- (ii) An optical fibre link has two splices with losses of 2dB and 3dB respectively. For a transmitting power of 1 dBm, determine the received power in watts. (8 marks)
8. (a) (i) Describe the principle of operation of the frequency division multiplexing (FDM) technique. (6 marks)
- (ii) State two application areas of FDM. (3 marks)
- (b) Eight channels of 300 kHz bandwidth each are to be multiplexed. A 10 kHz guardband exists between the channels. Determine the minimum required bandwidth. (3 marks)
- (c) Explain each of the following file compression formats:
- (i) JPEG;
- (ii) MPEG. (4 marks)



- (d) Table 3 shows symbols and their corresponding probabilities used in data compression.

Table 3

SYMBOL	A	B	C	D	E
PROBABILITY	0.22	0.28	0.15	0.30	0.05

- (i) Obtain the Shannon - fano codes for the given set of symbols.
- (ii) Determine the average code word length. (7 marks)

THIS IS THE LAST PRINTED PAGE.

