

2506/306

2507/306

**DATA COMMUNICATION AND  
COMPUTER NETWORKS**

**June/July 2023**

**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) Explain **two** functions of data terminal equipment (DTE). (4 marks)
- (b) Describe distributed networks with respect to data communication. (3 marks)
- (c) A pulse code modulator (PCM) system having a frequency of 8 KHZ transmits 8 bits. Determine the:
  - (i) minimum sampling rate;
  - (ii) bit rate. (4 marks)
- (d) With the aid of labelled diagrams, describe each of the following sampling methods:
  - (i) ideal sampling;
  - (ii) natural sampling;
  - (iii) flat-top sampling. (9 marks)

2. (a) Figure 1 shows a labelled diagram of a convolutional encoder. Describe its operation. (5 marks)

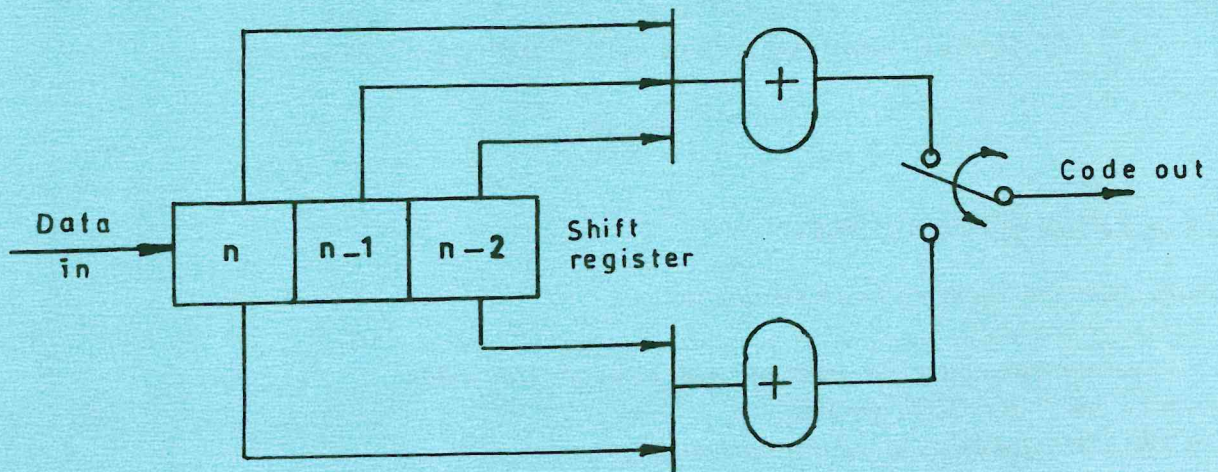


Fig. 1

- (b) Using a data word 1110010, describe each of the following modulation techniques:
  - (i) phase shift keying (PSK);
  - (ii) amplitude shift keying (ASK). (8 marks)
- (c) Represent the data word 110110001 in each of the following encoding techniques:
  - (i) polar non-return - to zero (NRZ);
  - (ii) unipolar return-to-zero (RZ);
  - (iii) differential manchester. (7 marks)



3. (a) Describe each of the following with respect to switching:
- circuit switched network;
  - datagram packet switched network.
- (4 marks)
- (b) State **three** areas of application of Frequency Division Multiplexing (FDM) technique.
- (3 marks)
- (c) A router is connected to four stations A, B, C, and D at a considerable distance through a data switch.
- draw the network layout;
  - the network layouts subnet address is 192.16.20.8, with a subnet mask of 255.255.255.248. Determine the:
    - host addresses for the network;
    - IP addresses for the router and the stations.
- (8 marks)
- (d) Figure 2 shows a packet switched network transmitting data from node A to F. Delay between the stations are as shown. Determine the:

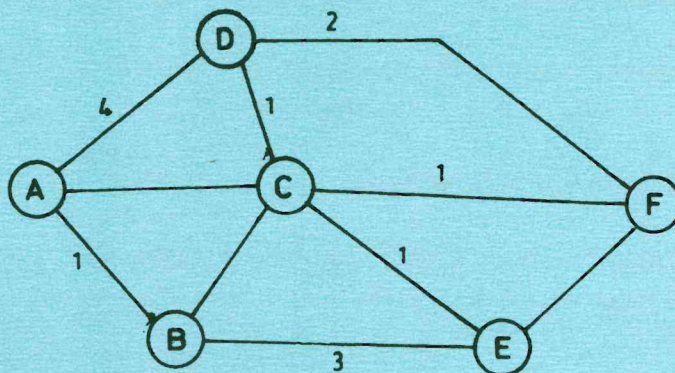


Fig.2

- longest route to the destination (F);
  - shortest route to F if node C is faulty.
- (5 marks)
4. (a) A data word 11100011 10101011 is to be coded and transmitted using checksum method of 8 bits. Determine the:
- checksum;
  - transmitted code word.
- (5 marks)



- (b) Outline steps followed in carrier sense multiple access with collision avoidance (CSMA/CA) medium access control protocol. (6 marks)
- (c) Describe how ethernet LAN configuration is carried out. (4 marks)
- (d) Draw the IEEE 802.11 frame format. (5 marks)
5. (a) Describe each of the following methods of data compression, stating one merit in each case:
- (i) lossy compression;
- (ii) lossless compression. (6 marks)
- (b) Explain the concept of Telnet protocol with respect to transmission control protocol/ internet protocol (TCP/IP). (4 marks)
- (c) A channel with a frequency range of 4 MHz to 5 MHz has a signal - to - noise ratio of 24 dB. Determine the:
- (i) bandwidth of the channel;
- (ii) signal-to-noise ration (SNR);
- (iii) channel capacity;
- (iv) signalling elements required. (8 marks)
- (d) Describe the 100BASE-T Ethernet LAN protocol. (2 marks)
6. (a) List **three** roles of the Communications Authority of Kenya (CAK). (3 marks)
- (b) With the aid of a labelled block diagram, describe the function of each component of a pulse code demodulator. (7 marks)
- (c) Figure 3 shows a labelled diagram of Run-Length-Encoding data compression technique. Describe its operation. (4 marks)

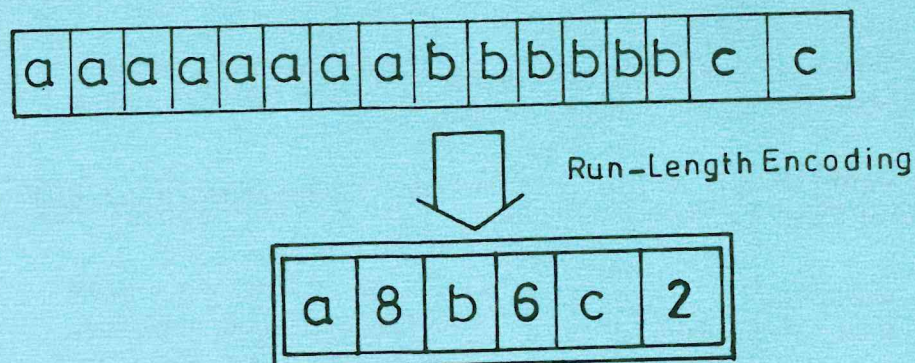


Fig. 3



(d) Describe each of the following back up data methods:

- (i) full back up;
- (ii) incremental back up;
- (iii) differential back up.

(6 marks)

7. (a) Figure 4 shows the construction of an optic fibre cable used as a transmission medium. Describe its operations. (6 marks)

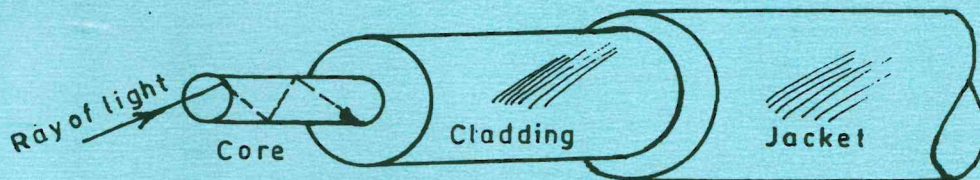


Fig. 4

(b) With the aid of a labelled diagram, describe video/audio streaming as used in data compression and multi-media. (6 marks)

(c) State **two** factors that would slow down streaming. (2 marks)

- (d) (i) Describe two elements of Huffman encoding in data compression.
- (ii) Table 1 shows characters and their respective probability in Huffman coding.

Table 1

Character	Probability (P)
a	0.45
b	0.24
e	0.11
d	0.08
e	0.07
f	0.05

Build coding tree to represent data compression in Huffman coding.

(6 marks)



8. (a) Describe the industrial, scientific and Medical Frequency Band (ISM). (2 marks)
- (b) With the aid of a labelled diagram, describe the hidden-node problem and suggest a remedy to overcome it. (6 marks)
- (c) Table 2 shows code words used in data transmission.

**Table 2**

<b>Codewords</b>	
1011010	
0110111	
1011001	

- Using even parity vertical redundancy check, determine the transmitted code word. (7 marks)
- (d) Draw a labelled diagram of differential pulse code modulation. (5 marks)

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