

2506/306

2507/306

DATA AND COMPUTER NETWORKS

June/July 2019

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;

Non programmable scientific calculator.

This paper consists of EIGHT questions.

Answer 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 5 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) (i) State the fundamental purpose of a communication system.
(ii) With the aid of a block diagram, describe the component blocks of a communication model. (8 marks)
- (b) Describe the following modes of transmission:
(i) half duplex;
(ii) full duplex. (4 marks)
- (c) With the aid of diagrams, describe the following:
(i) asynchronous transmission;
(ii) synchronous transmission. (8 marks)
2. (a) (i) Define line coding as used in data communication.
(ii) Describe the following coding techniques:
(I) manchester;
(II) differential manchester. (5 marks)
- (b) A code word 01001100011 is transmitted over a digital transmission network. Encode on a common graph the transmitted message using the following techniques:
(i) unipolar NRZ;
(ii) polar NRZ;
(iii) Bipolar Alternate Mark Inversion (AMI);
(iv) differential manchester. (8 marks)
- (c) With the aid of a diagram, describe frequency shift keying for a data word 010110. (7 marks)

3. (a) Describe Pulse Code Modulation (PCM). (3 marks)
- (b) List **three** limitations of the Pulse Code Modulation (PCM). (3 marks)
- (c) (i) Draw a block diagram of Pulse Code Modulation encoder.
(ii) Describe ideal sampling. (7 marks)
- (d) (i) A voice signal, whose frequency is 0 to 4 kHz is sampled at 8 bits per sample. Determine the:
(I) sampling rate;
(II) bit rate. (4 marks)
- (ii) Draw a component block diagram of delta modulation. (3 marks)

4. (a) Define the following as used in error detection and control:
(i) burst error;
(ii) single bit error. (2 marks)
- (b) (i) Describe hamming distance as used in error detection and control. (2 marks)
- (ii) Table 1 shows a code for error detection. Determine the minimum hamming distance of the coding scheme. (7 marks)

Table 1

S/No.	Data word	Code word
1	00	00000
2	01	01011
3	10	10101
4	11	11110

- (c) A transmitted data word, $D = 1010001101$ is encoded by a generator polynomial, $P = 110101$ to a receiver 10 km away. Using cyclic redundancy check, determine the:
(i) Frame Check Sequence (FCS);
(ii) transmitted code word. (9 marks)

5. (a) Define multiplexing as applied to data transmission. (1 mark)
- (b) With the aid of diagram, describe Frequency Division Multiplexing. (8 marks)
- (c) A voice channel occupies a bandwidth of 4 kHz. Three such voice channels are to be combined into a link with a bandwidth of 12 kHz, from 20 to 32 kHz. There are no guard bands used. Using frequency channel domain, show the configuration. (5 marks)
- (d) (i) A telecommunication system has 5 channels each with a 100 kHz bandwidth that are to be multiplexed. Guard bands of 10 kHz are fitted. Determine the:
- (I) total guard bands for the bandwidth; $\frac{100}{10} = 10 \text{ guard bands}$
- (II) minimum bandwidth of the link. $\frac{100 \times 5}{5} = 200 \text{ kHz}$

(4 marks)

- (ii) Differentiate between statistical time division multiplexing and synchronous time division multiplexing. (2 marks)

6. (a) List **three** standards used for protocol standardization. (3 marks)
- (b) State **four** roles played by the Kenya Bureau of Standards. (4 marks)
- (c) Table 2 shows characteristics of some high speed LANs. Complete the table (6 marks)

Table 2

S/No.	Characteristic	Fast Ethernet	Fibre channel	Wireless LAN
1.	Data rate		Fast	
2.	Transmission medium	Ethernet wire	Optical fibre	Air
3.	Access method	Ethernet cable	Fibre cable	Wireless Receiver

- (d) (i) State **three** services offered by IEEE802.11. (3 marks)
- (ii) Draw the IEEE802.11 architecture. (4 marks)

7. (a) Define the following as applied to data communication:

- (i) bridges;
- (ii) dedicated path.

(2 marks)

- (b) Describe the **three** phases in a circuit switched network. (6 marks)
- (c) A circuit-switched network connects computers in two remote offices of a private company. The offices are connected using a T-1 line leased from a communication service provider. There are two 4×8 switches in this network. For each switch 4 output ports are folded into the input ports to allow communication.
- (i) Sketch the network;
- (ii) State **three** limitations of the network in (i). (8 marks)
- (d) Figure 1 shows packet switching using virtual circuits with nodes 1, 2, 3, 4 and 5 from station A to B. Costs between nodes are indicated.

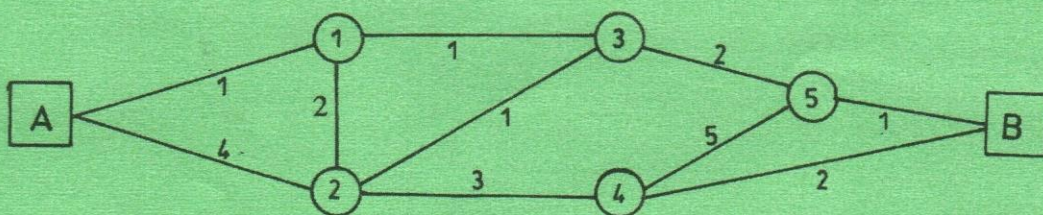


Fig. 1

Determine the:

- (i) route with least cost from A to B;
- (ii) most expansive route from A to B.

(4 marks)

8. (a) Describe the Huffman encoding. (4 marks)
- (b) With the aid of a diagram, describe how a compressed video file can be downloaded in MPEG format. (8 marks)
- (c) Describe lossless compression as used in multimedia communication. (2 marks)
- (d) With the aid of a diagram, describe Joint Photographic Experts Group (JPEG) process for compression images. (6 marks)

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