

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.

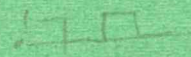
All questions carry equal marks.

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.

- X. (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)
- Z. (a) (i) Define line coding as used in data communication.
Polar Bipolar unipolar
- (ii) Describe the following coding techniques:
- (I) manchester; *Transits in the middle of bit. Changes phase when 0 is encountered*
- (II) differential manchester. *Transits in middle of bit. Changes phase when 1 is encountered* (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; *changes voltage level when 0 or 1 is encountered*
- (iii) Bipolar Alternate Mark Inversion (AMI); *changes phase when 1 is encountered*
- (iv) differential manchester. *transits in middle of bit* (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. *process of taking samples of message at regular* (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. *system that* (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;
- (II) minimum bandwidth of the link. (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			
2.	Transmission medium			
3.	Access method			

- (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.

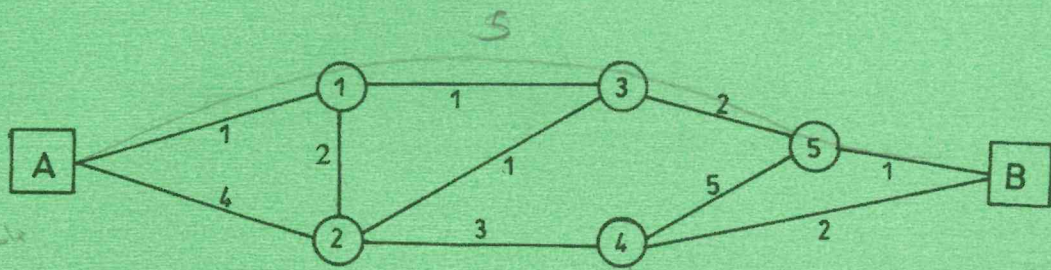


Fig. 1

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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