

2506/306

2507/306

DATA AND COMPUTER NETWORKS

Oct./Nov. 2018

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.*

*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 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) Define the following as used in data communication:

- (i) Data Terminal Equipment;
- (ii) Data Communication Equipment;
- (iii) encapsulation.

(3 marks)

(b) With the aid of a block diagram, describe a data communication model.

(6 marks)

(c) Describe the following transmission modes used in data transmission:

- (i) Point-to-point;
- (ii) multipoint;
- (iii) broadcast,

(6 marks)

(d) An optical fibre is made up of glass with the core and refractive indices of 1.55 and 1.51 respectively. Launching of light signal takes place from the air.

Determine the:

- (i) refractive loss;
- (ii) numerical aperture.

(5 marks)

2. ✓ (a) State **four** factors considered when choosing a data encoding scheme.

(4 marks)

(b) Encode the data sequence 101001101 using:

- (i) Manchester;
- (ii) Differential Manchester;
- (iii) Alternate Mark Inversion (AMI).

(9 marks)

(c) With the aid of a diagram, describe Quadrature Phase Shift Keying (QPSK) technique of digital modulation.

(7 marks)

3. (a) State **three** roles performed by Communication Authority of Kenya (CAK).

(3 marks)

(b) With the aid of a block diagram, describe the modulation process in a Pulse Code Modulation (PCM) transmitter.

(8 marks)



- (c) Four 1 Kpbs connections are multiplexed. A unit is 1-bit.

Determine the:

- (i) duration of 1-bit before multiplexing;
- (ii) transmission rate of the link;
- (iii) duration of one time slot;
- (iv) duration of a frame.

(7 marks)

- (d) Describe parallel transmission in digital communication.

(2 marks)

4. (a) Distinguish between single bit error and burst errors.

(2 marks)

- 9 (b) Describe:

- (i) the stop and wait automatic repeat request (ARQ) error control;
- (ii) how lost frames and/or acknowledgements are prevented in (i).

(7 marks)

- (c) (i) Define the following as used in error control:

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

(3 marks)

- (ii) A (7,4) cyclic code has a generator polynomial  $P(x) = X^5 + X^4 + X + 1$ . A source generates a message sequence  $M = [11100011]$ .

Determine the:

- (I) Frame Check Sequence (FCS) obtained;
- (II) transmitted code word.

(8 marks)



5/ (a) State **three** demerits of circuit switching. ✓ (3 marks)

11 (b) Table 1 shows different network devices. Complete the table. (4 marks)

Table 1

S/No.	Network devices	OSI Layer
1.	Repeater	
2.	Gateway	
3.	Switch	
4.	Router	

(c) With the aid of a diagram, describe virtual packet switching in data communication. (8 marks)

(d) A 2.5 kilobyte message is transmitted through a network with a bit rate of 1 Gbps. The distance between the sender and the receiver is 12,000 km. The propagation speed is  $2.4 \times 10^8$  m/s. Determine the:

(i) propagation time;

(ii) transmission time.

(5 marks)

6/ (a) State **three** merits of multiplexing in data communication. (3 marks)

7 (b) With the aid of a block schematic diagram, describe Synchronous Time Division Multiplexing (STDM) transmitter/receiver system used on data communication. (9 marks)

13 (c) Table 2 shows a Frequency Division Multiplexing (FDM) analogue hierarchy. Complete the table. (4 marks)

S/No.	Analog Hierarchy	Number of voice channels
1.	Group	
2.	Super group	
3.	Master group	
4.	Jumbo group	

(d) Highlight **four** advantages of optic fibre cable over twisted pair cable. (4 marks) ✓



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- (a) State **three** characteristics of Local Area Networks (LAN). (3 marks)
  - (b) With the aid of a diagram, describe bus topology. (6 marks)
  - (c) Outline the steps of carrier sense multiple access with collision detection (CSMA/CD) medium access control protocol. (5 marks)
  - (d) A channel operating at 4800 bps has a propagation delay of 20 mS. Determine the maximum frame size for stop and wait error control to get 50% link utilization. (6 marks)

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- (a) Distinguish between lossy and lossless compression. (2 marks)
  - (b) Describe JPEG technique of video compression. (4 marks)
  - (c) Table 3 shows part of OSI reference model. Complete the table. (8 marks)

Table 3

Layer	Name	Function
7		
6		
5		
4		

- (d) (i) State **four** tools used in structured cabling. (4 marks)
- (ii) List **two** connectors in installation of Ethernet. (2 marks)

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