

2506/306

2507/306

DATA AND COMPUTER NETWORKS

Oct./Nov. 2021

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) Define each of the following with respect to data communication:

- (i) data entity;
- (ii) decapsulation;
- (iii) routing.

(3 marks)

(b) Table 1 shows OSI functional grouping layers and their functions. Copy and match each layer with its corresponding functional grouping. (5 marks)

Table 1

OSI Layer	Functional Grouping
Transport layer	Routing
Physical layer	Framing
Application layer	Synchronisation
Data-link layer	Segmentation
Network layer	E-mailing

(c) Figure 1 shows a transmission mode used in data networks.

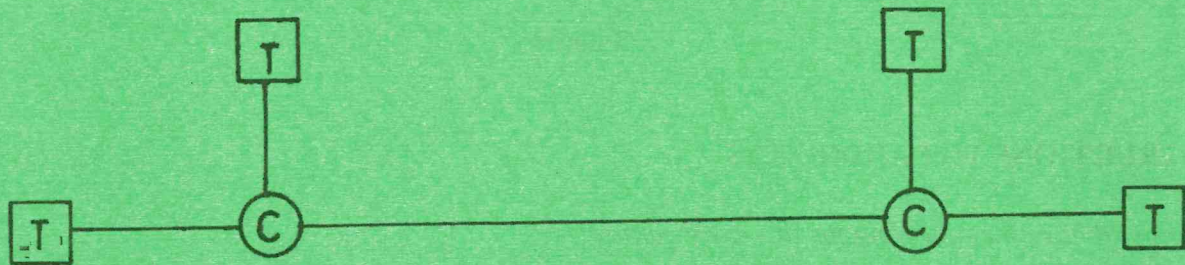


Fig.1

Identify the:

- (i) type of transmission mode;
- (ii) components labelled T and C;
- (iii) function of the parts in c(ii).

(5 marks)

(d) An organization is to connect 5 nodes in its network. Determine the total number of cable links needed for:

- (i) mesh topology;
- (ii) star topology;
- (iii) bus topology.

(7 mark)

2. (a) State **two** functions of Medium Access Control (MAC) sub-layer. (2 marks)
- (b) Draw and label the layers of the TCP/IP protocol suite used in data networks. (4 marks)
- (c) (i) State **two** characteristics of wireless personal area networks (W PANs)
- (ii) Draw a diagram illustrating a wireless personal area network. (6 marks)
- (d) The information in an analog signal voltage waveform is to be transmitted over a P.C.M system with a step size of 0.002. The analog voltage waveform has a bandwidth of 100 Hz and an amplitude range of - 10 V to + 10 V volts. Determine the:
- (i) minimum sampling rate required;
- (ii) number of quantization levels;
- (iii) number of bits in each PCM word;
- (iv) minimum bit rate required in the PCM signal. (8 marks)

3. (a) State **three** characteristics of forward error control. (3 marks)
- (b) (i) With the aid of a labelled diagram, describe stop and wait error control technique.
- (ii) Explain the need for flow control in data transmission. (8 marks)
- (c) Figure 2 shows a waveform for a data bit pattern encoded using Bi-polar Alternate Mark Inversion technique.

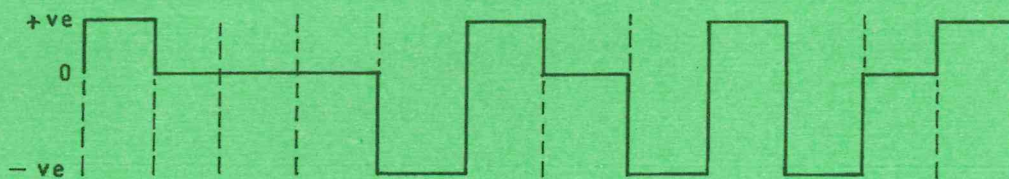


Fig.2

- (i) Determine the bit pattern;
- (ii) Using bit pattern in c(i) draw resultant waveforms for each of the following encoding schemes:
- (I) Manchester;
- (II) polar NRZ.

(9 marks)

4. (a) Define each of the following transmission impairments:

- (i) intermodulation noise;
- (ii) delay distortion;
- (iii) dispersion.

(3 marks)

(b) Describe each of the following network devices used in data communication:

- (i) switch;
- (ii) Brouter;
- (iii) Network Interface Card.

(6 marks)

(c) Table 2 shows alphabet of a discrete memory less source and their corresponding probabilities.

**Table 2**

Symbol	$S_0$	$S_1$	$S_2$	$S_3$	$S_4$
Probability	0.1	0.2	0.1	0.2	0.4

Determine the:

- (i) average code word length;
- (ii) huffman code;
- (iii) efficiency;
- (iv) redundancy.

(11 marks)

5. (a) Differentiate between serial and parallel data transmission. (2 marks)
- (b) With the aid of a labelled diagram, describe delta modulation technique. (8 marks)
- (c) Figure 3 shows a layout of a structured cabling LAN installation.

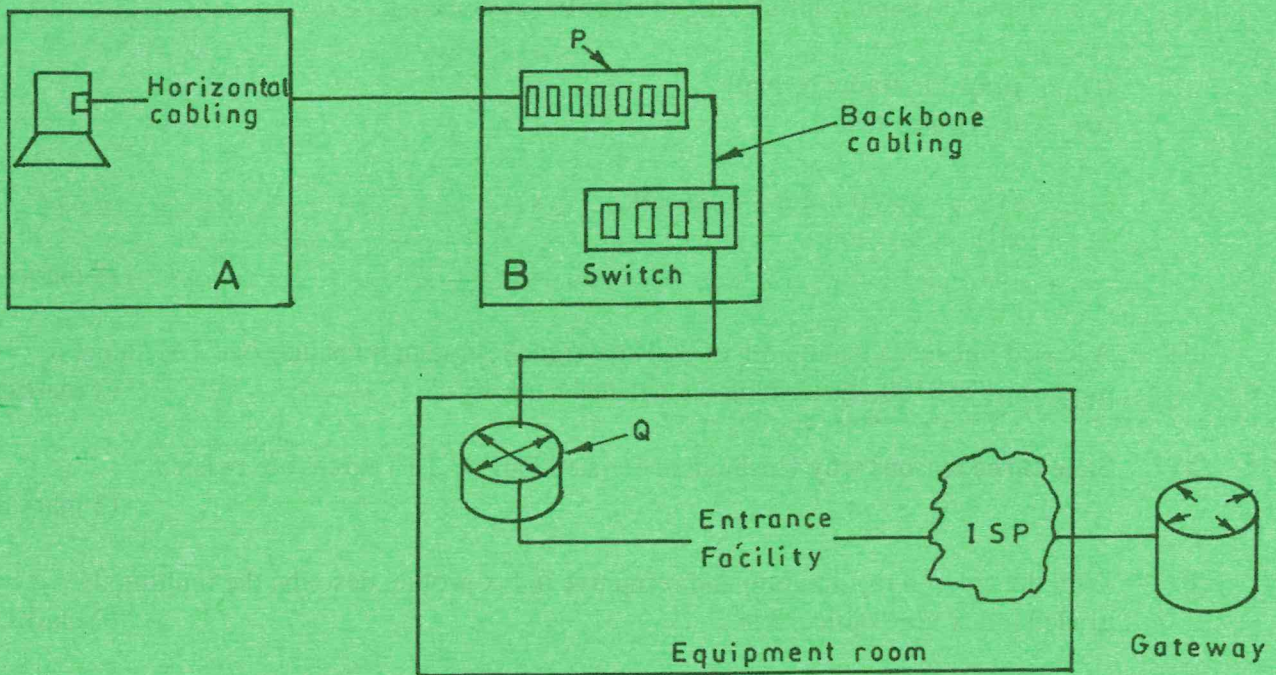


Fig. 3

- (i) Identify the:
- (I) blocks labelled A and B;
- (II) devices labelled P and Q.
- (ii) State two:
- (I) importance of device P;
- (II) functions of Internet Service Provider.

(10 marks)

6. (a) State **three** benefits of Virtual Private Networks (VPNs). (3 marks)
- (b) With the aid of a labelled diagram, describe Virtual Circuit Packet Switching technique. (7 marks)
- (c) For a Time Division Multiplexing (TDM) E1, system:
- (i) draw the frame format;
  - (ii) determine the:
    - (I) duration for 1 time slot;
    - (II) bit - rate.
- (8 marks)
- (d) A leased line has a bandwidth of 8 kHz assigned for data transmission. The signal to noise ratio is 8100. Determine the channel capacity. (2 marks)
7. (a) State **three** reasons why Unshielded Twisted Pair (U.T.P) cables are twisted. (3 marks)
- (b) With the aid of a ray diagram and refractive index profile, describe the multimode graded index fibre optic cable. (7 marks)
- (c) An optic fibre is made up of 1.57 and 1.53 respectively. The light to the optical system is launched from the air. Determine the:
- (i) numerical aperture;
  - (ii) acceptance angle;
  - (iii) critical angle.
- (6 marks)
- (d) Describe each of the following tools used in LAN installations:
- (i) crimping tool;
  - (ii) punch down tool.
- (4 marks)

8. (a) State **three** classes of Internet Protocol (IP) addressing. (3 marks)

(b) A network has an IP address of 222.62.40.0. Determine the:

- (i) class of network;
- (ii) subnet mask to obtain 8 subnets;
- (iii) first three subnet addresses;
- (iv) number of the first three hosts in the first subnet.

(11 marks)

(c) Describe each of the following types of routing techniques stating one area of application:

- (i) static;
- (ii) dynamic.

(6 marks)

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