

2506/306

2507/306

DATA AND COMPUTER

NETWORKS

June/July 2018

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

**DIPLOMA IN AERONAUTICAL ENGINEERING
(AIRFRAMES & 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 FIVE of the EIGHT questions in this paper.

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) Define the following terms as applied in data communication:
- (i) bandwidth;
 - (ii) data rate;
 - (iii) noise;
 - (iv) error rate.
- (4 marks)
- (b) In reference to data communication, differentiate between point-to-point and multi-point links, stating an example in each case. (4 marks)
- (c) Draw a block diagram of a typical data communication model and explain its constituents. (8 marks)
- (d) With the aid of a block diagram describe a distributed network. (4 marks)

X (a)

- (i) Distinguish between asynchronous and synchronous transmission with respect to data communication.
- (ii) With the aid of a block diagram, explain parallel transmission as applied to data communication. (8 marks)
- (b) Draw a block diagram of a pulse code modulation (PCM) and state functions of each block. (8 marks)
- (c) A noiseless channel has a bit rate of 265 kbps with a bandwidth of 20 kHz. Determine the number of signal levels required for the channel. (4 marks)

3.

- (a) Describe the Huffman FEC (forward error correction technique) method as used in data transmission. (4 marks)
- (b) (i) Explain the checksum error detection technique.
- (ii) A total of 128 capital A letters are sent across a communication link, given that the 7 bit ASCII code for the capital letter A is 1000001. Calculate the checksum to send for error detection. (10 marks)
- (c) A signal travels through a cable from a point A to point B. Determine:
- (i) the attenuation of the signal if at point B, the power is found to have reduced by a half;
 - (ii) the power of the signal at a point 5 km away from point B, if the power at B is 2 mW. (Assume attenuation of the cable is in decibels per kilometer (dB/km)). (6 marks)

4. (a) Define the following terms in relation
- (i) packetization;
 - (ii) encapsulation. (4 marks)
- (b) Contrast packet switching and circuit switching. (4 marks)
- (c) With the aid of a block diagram, explain the operation of a virtual circuit network. (6 marks)
- (d) (i) Explain routing table as applied in datagram network. (2 marks)
- (ii) Two buildings are connected using a T-1 line leased from a communication service provider which has two 2X4I/O switches. Each I/O switch has 2 outputs folded into the input port to allow communication. Draw a schematic diagram to realise this. (4 marks)
5. (a) Explain the following as applied in multiplexing:
- (i) channel;
 - (ii) pulse staffing. (4 marks)
- (b) Outline **three** distinguishing features between synchronous time division multiplexing and statistical time multiplexing. (6 marks)
- (c) A voice channel of 2800 Hz bandwidth is used for transmission of data over a telephone line with a signal to noise ratio of 20 dB. Determine the channel capacity in bits/sec. (6 marks)
- (d) In a multiplexed system, there are eight sources, each creating 250 characters per second. If the interleaved unit is a character and 1 synchronizing bit is added to each frame. Determine:
- (i) data rate of each source (in kbps);
 - (ii) duration of each character in each source (in mS). (4 marks)

6. (a) Outline **two** functions of each of the following standard Bodies concerned with data communication:

- (i) Communications Authority of Kenya (CAK)/CCK;
- (ii) Institute of Electrical and Electronic Engineers (IEEE).

(4 marks)

(b) (i) With the aid of a diagram in each case, explain the following LAN topologies:-

- (I) bus topology;
- (II) ring topology.

(ii) Outline **two** demerits for each case in b (i).

(16 marks)

7. (a) Outline four functions of each of the following LAN hardware devices:-

- (i) Network Interface Card (NIC);
- (ii) hub;
- (iii) switch;
- (iv) bridge.

(8 marks)

(b) A 1 Mbps link transmitting bits of frame length 8000 bits, established between two ground stations via a Geo stationery relay, at an altitude of 36,000 km. Determine the:

- (i) length of the link in bits;
- (ii) number of frames for the link;
- (iii) total time for transmission of the frame.

(12 marks)

- >v8. (a) (i) Differentiate between lossy and lossless data compression techniques. (6 marks)
- (ii) Explain the run length encoding data compression method. (2 marks)
- (b) Highlight the difference between intraframe and interframe MPEG compression standard. (2 marks)
- (c) (i) Describe coding efficiency as applied to data compression.
- (ii) Table 1 shows data obtained from a data compression using Shannon-Fano codes.

Table 1

Message	Uncompressed for messages	Codes probability of occurrence	Compressed codes for messages				
A	000	0.4	0				
B	001	0.2	1	0			
C	010	0.2	1	1	0		
D	Oil	0.1	1	1	1	0	
E	100	0.06	1	1	1	1	0
F	101	0.04	1	1	1	1	1

Using the table, determine the:

- (I) average number of bits per source message;
- (II) coding efficiency.
- (iii) Outline two demerits of using Shannon-Fano coding in data compression. (12 marks)

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