2506/306
2507/306
DATA COMMUNICATION AND COMPUTER NETWORKS
Oct./Nov. 2019
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN AERONAUTICAL ENGINEERING (AIRFRAMES AND ENGINES OPTION) (AVIONICS OPTION)

MODULE III

DATA COMMUNICATION AND COMPUTER NETWORKS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Answer booklet;
Mathematical tables/Non programmable scientific calculator.
*This paper consists of **EIGHT** questions.*
*Answer any **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 4 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) Draw a block diagram of a data communication system. (4 marks)

(b) With the aid of diagrams, describe the following modes of data communication:

(i) simplex;
(ii) full duplex.

(6 marks)

(c) Describe **two** types of errors in data transmission citing **one** example in each case. (6 marks)

(d) Outline the procedure of deriving the transmitted code using cyclic redundancy check (CRC) at the transmitter. (4 marks)

2. (a) Define the following with respect to data transmission:

(i) data rate;
(ii) multiplexing.

(2 marks)

(b) With the aid of a diagram, describe the Time Division Multiplexing (TDM) technique of data transmission. (6 marks)

(c) A Time Division Multiplexing (TDM) carrier with a bandwidth of 4 kHz uses synchronous TDM to transmit 30 voice channels using 6-bit samples. One synchronous bit is added to each channel and frame. Determine the:

(i) voice sampling rate;
(ii) voice bit rate;
(iii) total bit rate.

(8 marks)

(d) A data word 101000110 is transmitted in a medium. Draw the corresponding waveforms for:

(i) Manchester encoding;
(ii) Differential Manchester encoding.

(4 marks)

3. (a) Describe the following coding techniques:

(i) return-to-zero;
(ii) non-return-to-zero.

(4 marks)

(b) With the aid of waveforms, describe Bipolar Alternate Mark Inversion coding technique. (4 marks)

(c) A data word 00110100010, is modulated in a data transmission system. Draw the corresponding waveforms for the following techniques:

(i) amplitude shift keying;
(ii) frequency shift keying;
(iii) phase shift keying.

(6 marks)

(d) In a pulse code modulation system (PCM) a 5-bit encoder is used. Each level represents 1 volt. The voltage involved is 27.39 V. Determine the:

(i) quantization levels;
(ii) range of the encoder;
(iii) error on account of modulation.

(6 marks)

4. (a) Distinguish between physical and logical topologies in computer networks.

(2 marks)

(b) With the aid of diagrams, describe the following types of network topologies:

(i) star;
(ii) mesh.

(8 marks)

(c) (i) Define the following with respect to medium access control (MAC):

(I) polling;
(II) collision.

(ii) Explain the following medium access control (MAC) methods:

(I) carrier sensing multiple access;
(II) token passing.

(10 marks)

5. (a) (i) State **two** functions of switches in computer networks.

(ii) Describe the use of repeaters in networking.

(5 marks)

(b) Outline the procedure of network allocation vector (NAV) for collision avoidance in IEEE 802.11 protocol (5 marks)

(c) In a 10 Base 5 ethernet link, identify the following:

(I) baseband transmission;
(II) maximum segment length.

(2 marks)

(d) Describe **two** categories of fast ethernet. (8 marks)

6. (a) State **three** demerits of Frequency Division Multiplexing (FDM). (3 marks)

(b) With the aid of a diagram, describe the principle of Wavelength Division Multiplexing (WDM). (6 marks)

(c) State **three** merits of fibre optic cable. (3 marks)

(d) A data word, 10110011; 10101011; 01011010; 11010101, is transmitted in a communication medium using checksum error detection method. Determine:

(i) the checksum;
(ii) the sum computed at the receiver;
(iii) whether the data segments are accepted or discarded.

(8 marks)

7. (a) Describe modulation with respect to data communication. (2 marks)

(b) With the aid of waveforms, describe the pulse code modulation technique. (7 marks)

(c) A data word 1010 is transmitted in a medium, using hamming code error correction technique. Determine the:

(i) number of redundancy bits required;
(ii) data transmitted.

(8 marks)

(d) With the aid of a diagram, describe point to point communication network. (3 marks)

8. (a) Differentiate between JPEG and MPEG data compression techniques. (2 marks)

(b) Describe the run-length encoding as used in data compression. (3 marks)

(c) The following data stream is to be compressed before being transmitted: BBBBBBBBBAAAAAAAAAAAANNMMMMMMMM. Determine the compressed data using run-length encoding method. (5 marks)

(d) (i) State **two** advantages of packet switching over circuit switching.
(ii) Describe **two** types of packet switching.

(10 marks)

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