

2203/302  
DATA COMMUNICATION  
Oct. / Nov. 2006  
Time: 3 hours

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THE KENYA NATIONAL EXAMINATIONS COUNCIL  
DIPLOMA IN TELECOMMUNICATION ENGINEERING

DATA COMMUNICATION

3 hours

**INSTRUCTIONS TO CANDIDATES:**

*You should have the following for this examination:*

*Answer booklet*

*Non programmable calculator*

*Answer any FIVE of the following EIGHT questions.*

*All questions carry equal marks.*

**This paper consists of 5 printed pages**

**Candidates should check the question paper to ensure that all the pages are printed as indicated and no questions are missing.**

1. (a) (i) State any **six** desirable characteristics of optical receivers. (10 marks)
- (ii) Distinguish between modal and material dispersion.
- (b) Describe the following fiber optic cable system losses:
- (i) Input coupling
- (ii) Fiber attenuation
- (iii) Output coupling (6 marks)
- (c) Calculate the numerical aperture loss for an optical fiber where  $n_1 = 1.48$  and  $n_2 = 1.46$  assuming a Lambertian source is used. (4 marks)
2. (a) Explain any **one** advantage and **one** disadvantage of the following transmission techniques:
- (i) Asynchronous (4 marks)
- (ii) Synchronous
- (b) (i) Distinguish between synchronous and asynchronous TDM.
- (ii) With the aid of a diagram, describe the operation of a 4-channel time division multiplexing system. (12 marks)
- (c) Determine the information carrying capacity of a  $4\text{KHz}$  bandwidth channel that has a 35 dB S/N ratio. (4 marks)
3. (a) Explain any **two** features of the following transmission modes.
- (i) Simplex
- (ii) Half duplex
- (iii) Full duplex (6 marks)
- (b) Encode 1000100110 using
- (i) Differential Manchester
- (ii) Return zero bipolar
- (iii) Bipolar AMI (6 marks)

(c) With the aid of sketches describe the following digital-to-analogue techniques:

(i) Amplitude shift keying

(ii) Frequency shift keying

(iii) Phase shift keying

(6 marks)

(d) Using HDB3, encode the bit stream 100 00 00 00 00100. Assume that the number of 1s so far is odd and the first 1 is positive. (2 marks)

4. (a) Define the following error coding terms:

(i) block code

(ii) code word

(iii) code rate

(3 marks)

(b) State any **three** reasons why coding is necessary in data communication systems.

(3 marks)

(c) (i) Describe longitudinal redundancy check (LRC).

(ii) Perform longitudinal redundancy check on the following data stream:

11100111 11011101 00111001 10101001

(7 marks)

(d) (i) Describe the check sum error detection method.

(ii) Using a checksum of eight bits determine the pattern that is sent for the following block of 16 bits.

10101001 00111001

(7 marks)

5. (a) I Explain the need for line discipline in data transmission.

II Describe the following line discipline techniques.

(i) Enquiry/Acknowledgement

(ii) Poll/select

(8 marks)

(b) Describe with the aid of diagrams the:

(i) Go-Back-n Automatic Repeat Request (ARQ) method of error control.

(ii) Stop-and-wait method of flow control.

(10 marks)

(c) Explain the need for a buffer at the receiver in flow control.

(2 marks)

6. (a) List any **three** functions of the following OSI layers:
- (i) Physical
  - (ii) Data link
  - (iii) Network
- (9 marks)
- (b) (i) Distinguish between character and bit oriented protocols.
- (ii) I Define data transparency.
- II With the aid of sketches, explain how data transparency is implemented
- (8 marks)
- (c) Explain the following configurations with reference to communication device links.
- (i) Unbalanced
  - (ii) Symmetrical
  - (iii) Balanced
- (3 marks)

7. (a) Explain any **three** features of the following switching formats:
- (i) Circuit
  - (ii) Packet
  - (iii) Message
- (9 marks)
- (b) (i) With the aid of relevant sketches, describe the switched virtual circuit approach to packet switching.
- (ii) Highlight **two** essential differences between circuit switched and virtual circuit connection.
- (9 marks)
- (c) Explain how switching has helped eliminate the problem of connection between devices.
- (2 marks)

8. (a) State the functions of the following network devices:
- (i) Network adapter card
  - (ii) Repeater
  - (iii) Concentrator
  - (iv) Bridge
  - (v) Router
  - (vi) Multiplexer
- (6 marks)



- (b) (i) Describe the following LAN access methods.
- I Carrier Sense Multiple Access with collision detector (CSMA/CD)
  - II Carrier Sense Multiple Access with collision avoidance (CSMA/CA)
- (ii) Explain the drawbacks of each of the access methods in b (i). (10 marks)
- (c) Explain any **four** features for **one** of the following network architecture:
- (i) Ethernet
  - (ii) Token ring

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