2506/306
2507/306
DATA AND COMPUTER NETWORKS
March/April 2024
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.;
Drawing instruments.
*This paper consists of **EIGHT** questions.*
*Answer **FIVE** of the **EIGHT** questions in the answer booklet provided.*
All questions carry equal marks.
Maximum marks for each part of a question are shown.
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) Differentiate between lossless compression and lossy compression as used in multimedia systems. (4 marks)

(b) (i) Describe the run-length Encoding (RLE) data compression method.

(ii) Table 1 shows runs of data using RLE. Obtain the compressed data. (7 marks)

Table 1

a	a	a	a	a	b	b	b	c	c	c	d	d	d	d

(c) State **three** merits of data/ video compression in multimedia systems. (3 marks)

(d) Describe **three** Joint Picture Expert Group (JPEG) modes of operations. (6 marks)

2. (a) State **three** merits of a switch in a computer network. (3 marks)

(b) Table 2 shows high speed LAN protocols and their characteristics. Compete the table. (4 marks)

Table 2

Protocol Type	**Distance**	**Type of cable used**
10 Base 2		Twisted pair
10 Base F		
10 Base 5	500 M	

(c) (i) Draw a labelled layered diagram of IEEE 802.11 LAN standard.
(ii) Describe the function of each layer in (c)(i). (8 marks)

(d) (i) State **two** merits of wireless LANs (WLANs).
(ii) Explain the service set identifier (SSID) as used in wireless LANs. (5 marks)

3. (a) With the aid of labelled diagrams, distinguish between statistical Time Division Multiplexing and synchronous Time Division Multiplexing. (8 marks)

(b) Figure 1 shows an optical fibre cable used to transmit data. Its core and cladding refractive indices are 1.47 and 1.44 respectively. Launching takes place from the air.

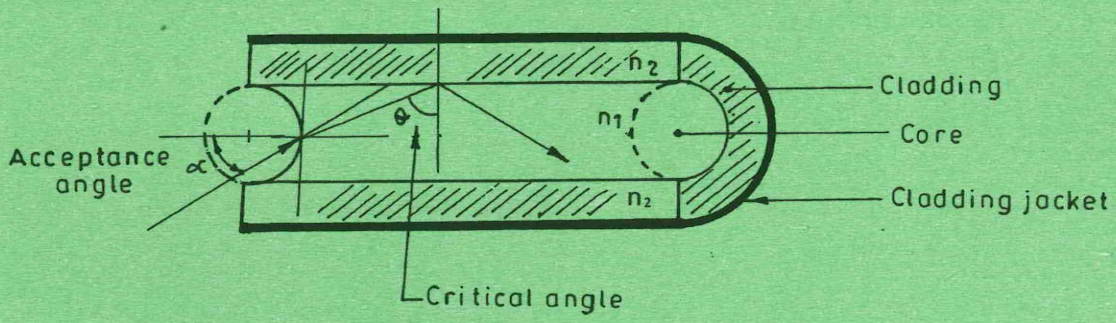

Fig.1

Determine the:

(i) critical angle θ;
(ii) angle of acceptance α;
(iii) numerical aperture. (6 marks)

(c) (i) List **two** merits of frequency division multiplexing.
(ii) The following are components that make up a Time Division Multiplexing System:

- Data input; A, B, C, D each at data rate of 10 kbps
- Data selector switch;
- Single Data channel and output.

Determine the output data rate and draw the system layout. (6 marks)

4. (a) Describe datagram packet switching. (4 marks)

(b) Figure 2 shows a routing network for data frame transmission. The route cost for each link is an indicated.

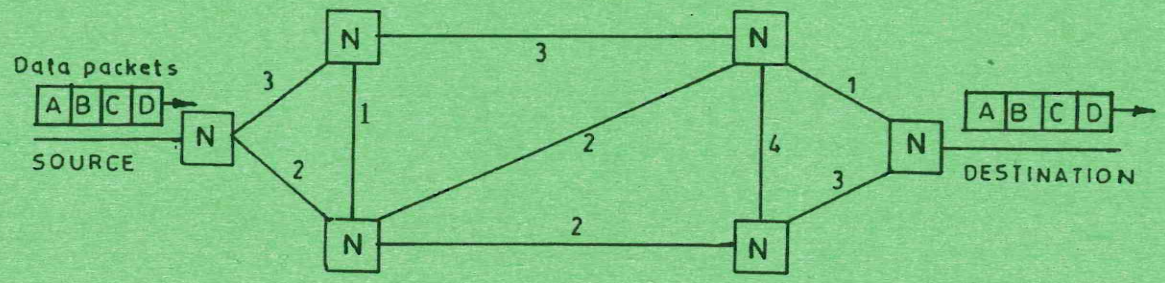

Fig. 2

(i) Determine the routing cost of each possible route from the source to the destination.

(ii) State the:

I. route with least cost;
II. route with highest cost. (8 marks)

(c) Explain the routing protocol as used in computer networks. (3 marks)

(d) With the aid of a labelled diagram, describe the working principle of flooding routing protocol computer networks. (5 marks)

5. (a) Describe each of the following:

(i) convolution codes;
(ii) backward error correction. (4 marks)

(b) Table 3 shows code words in a data network. Determine the:

(i) transverse redundancy check using odd parity;
(ii) longitudinal redundancy check using even parity. (6 marks)

Table 3

1	1	1	0	0	1	0
1	1	0	1	1	1	0
0	0	1	1	1	0	0
1	0	1	0	1	0	1

(c) A message sequence 1101101, is to be transmitted using a generation polynomial

$P(X) = X^4 + X + 1$

Using Cyclic Redundancy Check, determine the:

(i) Frequency Check Sequence (FCS);
(ii) Transmitted code word. (8 marks)

(d) Describe STOP and WAIT flow control technique. (2 marks)

6. (a) With the aid of a labelled block diagram, describe the Differential Pulse Code Modulation Transmitter. (6 marks)

(b) State two merits of Delta Modulattion. (2 marks)

(c) An analogue signal occupying the frequency range 0 - 4 kHz is to be transmitted using a PCM system. Each quantification level is encoded using 8 bits. Determine the:

(i) minimum sampling rate;
(ii) bit rate;
(iii bandwidth. (6 marks)

(d) Figure 3 shows a digital data signal to be transmitted.

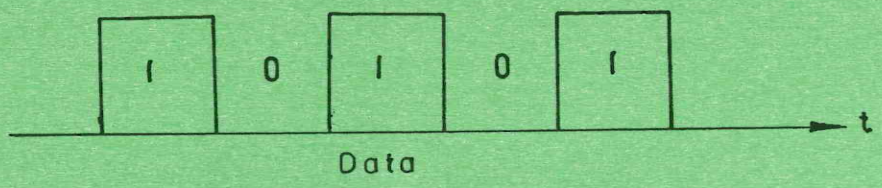

Fig. 3

Draw the resultant waveform for each of the following modulation schemes:

(i) Amplitude Shift Keying (ASK);

(ii) Frequency Shift Keying (FSK). (6 marks)

7. (a) List **three** functions of line codes. (3 marks)

(b) Represent a data word 101011100 using each of the following encoding techniques:

(i) unipolar Non-Return-to Zero (NRZ);
(ii) Bipolar, AMI;
(iii) Manchester. (9 marks)

(c) With the aid of a labelled block diagram and waveforms, describe Quadrature Amplitude Modulator. (8 marks)

8. (a) State **two** data transmission impairments. (2 marks)

(b) With the aid of a block diagram, describe the basic components of a communication system. (8 marks)

(c) An organization has a subnet mask of 255.255.255.240. Determine the:

(i) default mask;
(ii) class of IP address;
(iii) number of bits borrowed for the subnet;
(iv) number of subnets. (5 marks)

(d) (i) With the aid of a labelled diagram, show how the TCP/IP protocol suite is mapped onto the OSI layered model.

(ii) State **one** function of uppermost layer of the OSI layered model. (5 marks)

Decimal - Binary - Octal - Hex – ASCII Conversion Chart

Decimal	Binary	Octal	Hex	ASCII	Decimal	Binary	Octal	Hex	ASCII	Decimal	Binary	Octal	Hex	ASCII	Deci
0	00000000	000	00	NUL	32	00100000	040	20	SP	64	01000000	100	40	@	9
1	00000001	001	01	SOH	33	00100001	041	21	!	65	01000001	101	41	A	9
2	00000010	002	02	STX	34	00100010	042	22	"	66	01000010	102	42	B	9
3	00000011	003	03	ETX	35	00100011	043	23	#	67	01000011	103	43	C	9
4	00000100	004	04	EOT	36	00100100	044	24	$	68	01000100	104	44	D	10
5	00000101	005	05	ENQ	37	00100101	045	25	%	69	01000101	105	45	E	10
6	00000110	006	06	ACK	38	00100110	046	26	&	70	01000110	106	46	F	10
7	00000111	007	07	BEL	39	00100111	047	27	'	71	01000111	107	47	G	10
8	00001000	010	08	BS	40	00101000	050	28	(	72	01001000	110	48	H	10
9	00001001	011	09	HT	41	00101001	051	29	)	73	01001001	111	49	I	10
10	00001010	012	0A	LF	42	00101010	052	2A	*	74	01001010	112	4A	J	10
11	00001011	013	0B	VT	43	00101011	053	2B	+	75	01001011	113	4B	K	10
12	00001100	014	0C	FF	44	00101100	054	2C	,	76	01001100	114	4C	L	10
13	00001101	015	0D	CR	45	00101101	055	2D	-	77	01001101	115	4D	M	10
14	00001110	016	0E	SO	46	00101110	056	2E	.	78	01001110	116	4E	N	1
15	00001111	017	0F	SI	47	00101111	057	2F	/	79	01001111	117	4F	O	1
16	00010000	020	10	DLE	48	00110000	060	30	0	80	01010000	120	50	P	1
17	00010001	021	11	DC1	49	00110001	061	31	1	81	01010001	121	51	Q	1
18	00010010	022	12	DC2	50	00110010	062	32	2	82	01010010	122	52	R	1
19	00010011	023	13	DC3	51	00110011	063	33	3	83	01010011	123	53	S	1
20	00010100	024	14	DC4	52	00110100	064	34	4	84	01010100	124	54	T	1
21	00010101	025	15	NAK	53	00110101	065	35	5	85	01010101	125	55	U	1
22	00010110	026	16	SYN	54	00110110	066	36	6	86	01010110	126	56	V	1
23	00010111	027	17	ETB	55	00110111	067	37	7	87	01010111	127	57	W	1
24	00011000	030	18	CAN	56	00111000	070	38	8	88	01011000	130	58	X	1
25	00011001	031	19	EM	57	00111001	071	39	9	89	01011001	131	59	Y	1
26	00011010	032	1A	SUB	58	00111010	072	3A	:	90	01011010	132	5A	Z	1
27	00011011	033	1B	ESC	59	00111011	073	3B	;	91	01011011	133	5B	[	1
28	00011100	034	1C	FS	60	00111100	074	3C	<	92	01011100	134	5C	\	1
29	00011101	035	1D	GS	61	00111101	075	3D	=	93	01011101	135	5D	]	1
30	00011110	036	1E	RS	62	00111110	076	3E	>	94	01011110	136	5E	^	1
31	00011111	037	1F	US	63	00111111	077	3F	?	95	01011111	137	5F	_	1

ASCII Conversion Chart.doc Copy

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