00309

Sri Lanka Institute of Information Technology

B.Sc. Special Honors Degree in Information Technology

Repeat Examination

Year 1, Semester I – (CSN/IT)

2016 – April (EC 143)

EC143 - Data Communications & Computer Networks I

Duration: 3 Hours

Instructions to Candidates:

- This paper contains Four (04) questions printed on Seven (07) pages.
- **Answer all the questions** in the given answer booklet.
- Total marks **100**.
- You are **permitted** to use calculators.

Question 01 **(25 marks)**

1. What is the differerence between half-duplex and full-duplex transmission methods? Provide examples for each. (2 marks)

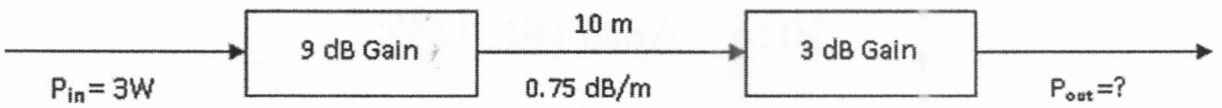
2. What is thermal noise and how it is generated? (3 marks)

3. How long would it take an image which is 1024 pixels by 768 pixels with 8 bit per pixel color encoding to transfer via a 9.6 kbps communication link? (3 marks)

4. Explain the features of a multicast network? (2 marks)

5. Explain an advantage of layered architecture on to ISO-OSI seven layers. (1 mark)

6. Find the output power of the transmission line shown in Figure 1. (4 marks)



7. A computer's memory chip takes 166.6 ns to read/write data per cycle. What is the clock frequency of the memory? (3 marks)

8. A non periodic composite signal has a bandwidth of 200 kHz with the middle frequency of 140 kHz and peak amplitude of 20V. The two extreme frequencies have an amplitude of 0. Draw the frequency domain of the signal. (3 marks)

9. Show the bit pattern in an asynchronous transmission with one start and one stop bit if the data to be sent is "Hello". Use the ASCII conversion chart given in Appendix A. (4 marks)

Question 02 **(25 marks)**

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1. Consider a band-pass signal with a bandwidth of 400 MHz, if the lowest frequency is 100 KHz . Assuming eight bits per sample answer the following questions.

   a. The minimum bit rate of the output signal? (2 marks)

   b. "To increase the quality of the generated digital signal, sampling rate has to be increased". Comment on this statement. (3 marks)

   c. Above mentioned analog-to-digital conversion has used non linear quatization to minimize the error. Explain how it will reduce the error compaired to linear quantization. (3 marks)

   d. Explain the advantage of using digital signals in communication than analog. (3 marks)

2. A cable company uses one of the cable TV channels with the bandwidth of 6 MHz to provide digital communication for each resident. What is the available data rate for each resident if the company uses a 128-QAM technique? (4 marks)

3. A TDM multiplexer is combine 25 digital sources, each of 100 Kbps. Each output slot carries 1 bit (bit interleaving) from each digital source, and one extra bit is added to each frame for synchronization. Answer the following questions.

   a. What is the size of an output frame in bits? (1 mark)

   b. What is the output frame rate? (2 marks)

   c. What is the duration of an output frame? (2 marks)

   d. What is the output data/bit rate? (3 marks)

   e. What is the efficiency of the system? (2 marks)

Question 03 **(25 marks)**

1. Explain four physical layer responsibilities in data communication. (2 marks)

2. Error control is one of the main functionalities in data link layer.

   a. What are the main objectives defined under error control? (1 mark)

   b. Explain the basic procedure in Cyclic Redundancy Check (CRC). (3 marks)

   c. Explain an advantage in Forward Error Correction (FEC) compared to Backward Error Correction (BEC). (2 marks)

3. Draw Automatic Repeat Request (ARQ) timing diagrams for the followings.

   a. Send three frames and 2nd frame has errors - use Idle ARQ (2 marks)

   b. Send five frames and 3rd frame has errors - use selective ARQ (2 marks)

   c. Send five frames and 3rd frame has errors- use Go-Back-N ARQ (2 marks)

   d. In which types of circumstances the above mentioned three ARQ methods will be used? Justify your answer. (3 marks)

4. Briefly explain three types of frames used in High Level Data Link Control (HDLC). (2 marks)

5. Draw the Line Coding for the following encoding methods using the given bit pattern.
   Bit pattern: 1 0 1 1 0 1 0 1 0 0

   a. Unipolar RZ (25% duty cycle) encoding (1 mark)

   b. AMI (Bipolar RZ – 50% duty cycle) encoding (1 mark)

   c. Manchester encoding (start from low voltage level) (2 marks)

   d. Differential Manchester encoding (start from high voltage level) (2 marks)

Question 04 **(25 marks)**

1. With the aid of a diagram illustrate how the layers of the TCP/IP protocol suite do correlate to the layers of the OSI model and specify one protocol used for each layer in the internet model. (2 marks)

2. Draw the bellow table in your answer booklet and fill in the blanks. (6 marks)

Device	Main task of the device	Layer it operates	No. of Collision domains	No. of Broadcast domains
Bridge				
Layer 2 Switch (16 Ports)				
Router (4 Ports)				

3. You are been asked to design a network for a company located in a two storied building. Following are the requirements for the network.
   - o 15 computers on the ground floor and 23 computers on the first floor.
   - o Requires internet connectivity for both first and the ground floors.
   - o Ground floor printer should be able to share with first floor computers.
   - o Facility to use the internet for portable computers on the office in both the floors.

   a. Sketch a network topology diagram and label all devices. (3 marks)
   b. Indicate all types of network connection. (3 marks)
   c. Explain how you would provide internet facility to the entire building. (3 marks)

4. Consider the following scenario in TCP / IP model and Ethernet frame in LAN Model.

   3450 bytes of application layer data are going through transport layer, network layer, and data link layer. Maximum Transfer Unit (MTU) of Ethernet frame is 1500 bytes.

   a. Draw the TCP segment (2 marks)
   b. IP packet /s (3 marks)
   c. Ethernet frame /s (3 marks)

   Write the number of bytes in each header and data sections.

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Decimal - Binary - Octal - Hex – ASCII Conversion Chart

Decimal	Binary	Octal	Hex	ASCII	Decimal	Binary	Octal	Hex	ASCII	Decimal	Binary	Octal	Hex	ASCII	Decimal	Binary	Octal	Hex	ASCII
0	00000000	000	00	NUL	32	00100000	040	20	SP	64	01000000	100	40	@	96	01100000	140	60	`
1	00000001	001	01	SOH	33	00100001	041	21	!	65	01000001	101	41	A	97	01100001	141	61	a
2	00000010	002	02	STX	34	00100010	042	22	"	66	01000010	102	42	B	98	01100010	142	62	b
3	00000011	003	03	ETX	35	00100011	043	23	#	67	01000011	103	43	C	99	01100011	143	63	c
4	00000100	004	04	EOT	36	00100100	044	24	$	68	01000100	104	44	D	100	01100100	144	64	d
5	00000101	005	05	ENQ	37	00100101	045	25	%	69	01000101	105	45	E	101	01100101	145	65	e
6	00000110	006	06	ACK	38	00100110	046	26	&	70	01000110	106	46	F	102	01100110	146	66	f
7	00000111	007	07	BEL	39	00100111	047	27	'	71	01000111	107	47	G	103	01100111	147	67	g
8	00001000	010	08	BS	40	00101000	050	28	(	72	01001000	110	48	H	104	01101000	150	68	h
9	00001001	011	09	HT	41	00101001	051	29	)	73	01001001	111	49	I	105	01101001	151	69	i
10	00001010	012	0A	LF	42	00101010	052	2A	*	74	01001010	112	4A	J	106	01101010	152	6A	j
11	00001011	013	0B	VT	43	00101011	053	2B	+	75	01001011	113	4B	K	107	01101011	153	6B	k
12	00001100	014	0C	FF	44	00101100	054	2C	,	76	01001100	114	4C	L	108	01101100	154	6C	l
13	00001101	015	0D	CR	45	00101101	055	2D	-	77	01001101	115	4D	M	109	01101101	155	6D	m
14	00001110	016	0E	SO	46	00101110	056	2E	.	78	01001110	116	4E	N	110	01101110	156	6E	n
15	00001111	017	0F	SI	47	00101111	057	2F	/	79	01001111	117	4F	O	111	01101111	157	6F	o
16	00010000	020	10	DLE	48	00110000	060	30	0	80	01010000	120	50	P	112	01110000	160	70	p
17	00010001	021	11	DC1	49	00110001	061	31	1	81	01010001	121	51	Q	113	01110001	161	71	q
18	00010010	022	12	DC2	50	00110010	062	32	2	82	01010010	122	52	R	114	01110010	162	72	r
19	00010011	023	13	DC3	51	00110011	063	33	3	83	01010011	123	53	S	115	01110011	163	73	s
20	00010100	024	14	DC4	52	00110100	064	34	4	84	01010100	124	54	T	116	01110100	164	74	t
21	00010101	025	15	NAK	53	00110101	065	35	5	85	01010101	125	55	U	117	01110101	165	75	u
22	00010110	026	16	SYN	54	00110110	066	36	6	86	01010110	126	56	V	118	01110110	166	76	v
23	00010111	027	17	ETB	55	00110111	067	37	7	87	01010111	127	57	W	119	01110111	167	77	w
24	00011000	030	18	CAN	56	00111000	070	38	8	88	01011000	130	58	X	120	01111000	170	78	x
25	00011001	031	19	EM	57	00111001	071	39	9	89	01011001	131	59	Y	121	01111001	171	79	y
26	00011010	032	1A	SUB	58	00111010	072	3A	:	90	01011010	132	5A	Z	122	01111010	172	7A	z
27	00011011	033	1B	ESC	59	00111011	073	3B	;	91	01011011	133	5B	[	123	01111011	173	7B	{
28	00011100	034	1C	FS	60	00111100	074	3C	<	92	01011100	134	5C	\	124	01111100	174	7C	|
29	00011101	035	1D	GS	61	00111101	075	3D	=	93	01011101	135	5D	]	125	01111101	175	7D	}
30	00011110	036	1E	RS	62	00111110	076	3E	>	94	01011110	136	5E	^	126	01111110	176	7E	~
31	00011111	037	1F	US	63	00111111	077	3F	?	95	01011111	137	5F	_	127	01111111	177	7F	DEL

Appendix A

~ End of the Question Paper ~