UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013

COURSE NAME	:	DIGITAL COMMUNICATIONS
COURSE CODE	:	BEX 43203 / BEP 4113
PROGRAMME	:	BEE
EXAMINATION DATE	:	DECEMBER 2012 / JANUARY 2013
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY.

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

Q1 (a) Given an input signal for $n = 0,1,2,3,4$ as shown in Figure Q1(a). Generate the PCM sequences of the input signal, $x(n)$ using 3 bits quantizer.

(7 marks)

(b) Construct the pulse waveform of this PCM sequences, "10110001101" in the following format,

(i) dicode RZ.

(ii) delay modulation.

(6 marks)

(c) Construct the compression signal given in Figure Q1(c) using A-law compression characteristic.

(7 marks)

Q2 (a) Compress this message using Huffman coding:

"ooooppss_sorry_sir"

(14 marks)

(b) Generate Hamming (7,4) code for this message:

"011110000100"

(6 marks)

Q3　(a)　Determine the baudrate of a system which has the constellation diagram of eight equally space points on a circle.

(5 marks)

(b)　In digital modulation technique, the frequency shift keying, FSK uses different frequency to encode the binary data. Consider the carrier frequency of 1 Hz, construct the FSK signal for the PCM sequences given as:

$$x(n) = \{ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 1\ 0 \}$$

(5 marks)

(c)　Plot the bit error probability curve of BPSK modulation from -2dB to 9dB using 1 dB step size of E_b/N_0.

(10 marks)

Q4　(a)　Consider a message "ABCABABCAB", Calculate the entropy of

(i)　This message,
(ii)　Alphabet A,
(iii)　Alphabet AB, and
(iv)　Alphabet ABC.

(8 marks)

(b)　Illustrate and explain each of the component of Analog to Digital Converter (ADC).

(8 marks)

(c) Caculate the channel capacity of ASK modulation system using carrier frequency of 100 kHz. Assume the SNR of the transmission system is 0.1 dB.

(4 marks)

Q5 (a) Compute the ASCII code for each character in Table Q5(a) followed by an 8th bit for error detection per character. The 8th bit is chosen so that the number of ones in the total 8 bits is even number.

(10 marks)

(b) Sketch the constalletion diagram for the following signals:

(ii) BPSK
(iii) QPSK

(4 marks)

(c) Sketch the matched filter and derive the variance of the output for the matched filter.

(6 marks)

Q6 (a) Discuss the advantages, disadvantages and the example of the application system between the TDMA, FDMA and CDMA.

(6 marks)

(b)   Discuss the features of DSSS.

(4 marks)

(c)   Sketch the spreading circuit of DSSS and generate the spreading code for the source information of "1011101" if the spreading code is clocked at a rate 3 times faster than the source.

(10 marks)

Q7 (a)   An analog audio voice frequency (VF) telephone signal has a band from 300Hz to 3400Hz. The signal is to be converted to a 8 bits PCM signal for tranmission over a digital telephone system. Compute the following:

    (i)   minimum sampling frequency

    (ii)   bit rate

    (iii)   bandwidth when a rectangular shape is used.

(6 marks)

(b)   Binary information is transmitted at rate of 200 kbps using FSK modulation technique. If the received carrier amplitude is 10^3 V and the additive noise power, $N_o = 10^{-12}$ W/Hz.

    (i)   Design a coherent detector and calculate the bit error rate.

    (ii)   Design an incoherent detector and calculate the bit error rate.

(14 marks)

-END OF QUESTION-

Graph of x(n)

FIGURE Q1(a)

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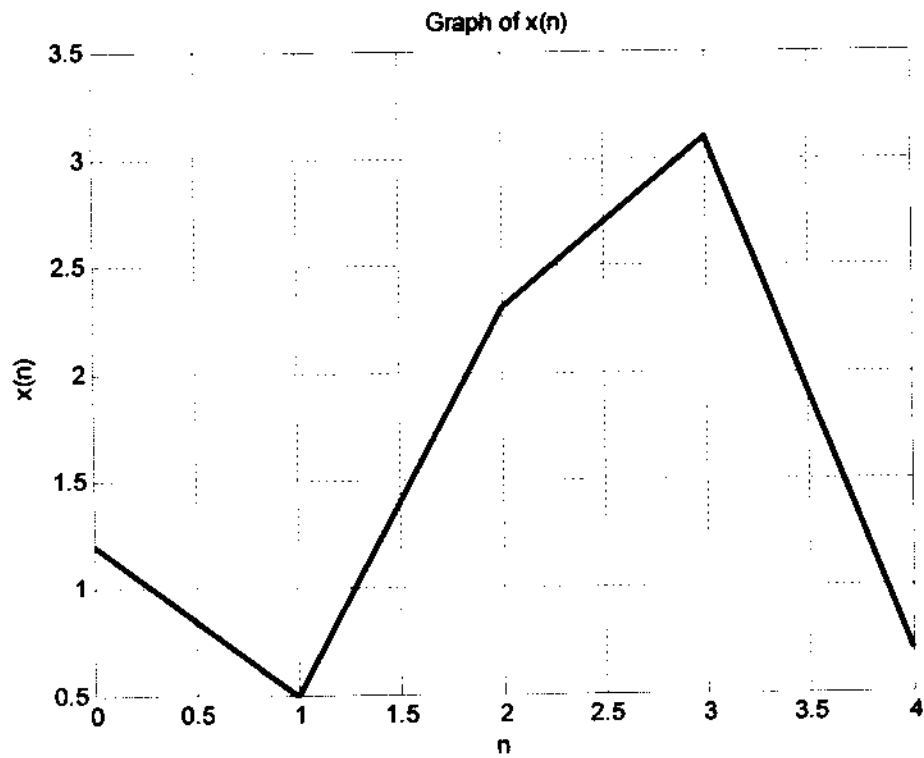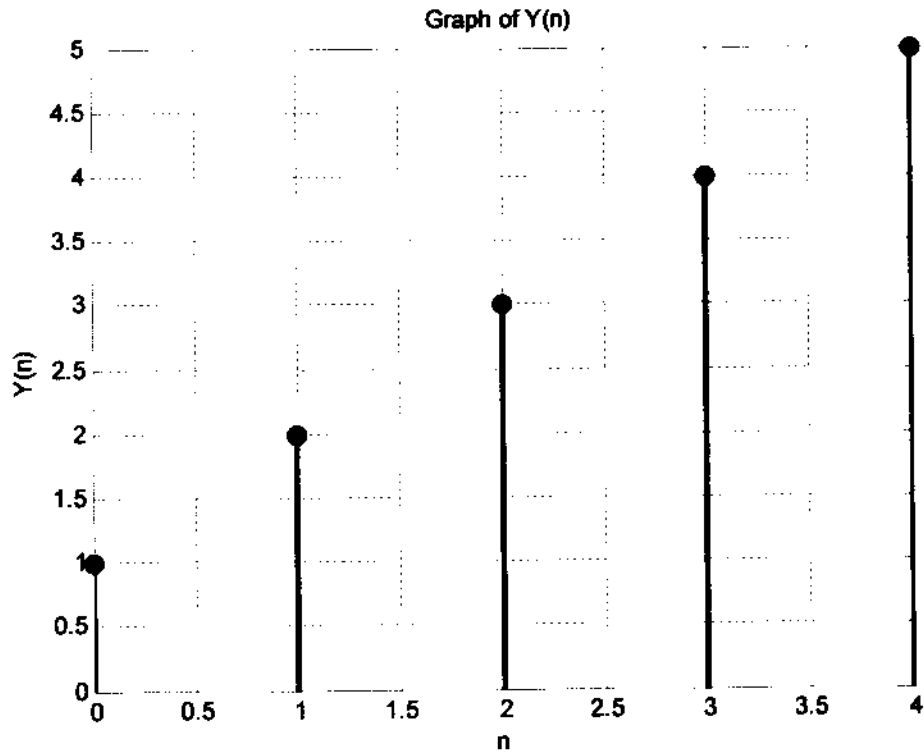COURSE NAME : DIGITAL COMMUNICATIONS   COURSE CODE : BEX 43203 / BEP 4113

Graph of Y(n)

FIGURE Q1 (c)

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TABLE Q3 (c)

x	erf x	x	erf x	x	erf x	x	erf x
		0.39 ...		**0.79 ...**		**1.19 ...**	
0.00	0.000000	0.40	0.428392	0.80	0.742101	1.20	0.910314
0.01	0.011283	0.41	0.437969	0.81	0.748003	1.21	0.912956
0.02	0.022565	0.42	0.447468	0.82	0.753811	1.22	0.915534
0.03	0.033841	0.43	0.456887	0.83	0.759524	1.23	0.918050
0.04	0.045111	0.44	0.466225	0.84	0.765143	1.24	0.920505
0.05	0.056372	0.45	0.475482	0.85	0.770668	1.25	0.922900
0.06	0.067622	0.46	0.484655	0.86	0.776100	1.26	0.925236
0.07	0.078858	0.47	0.493745	0.87	0.781440	1.27	0.927514
0.08	0.090078	0.48	0.502750	0.88	0.786687	1.28	0.929734
0.09	0.101282	0.49	0.511668	0.89	0.791843	1.29	0.931899
0.10	0.112463	0.50	0.520500	0.90	0.796908	1.30	0.934008
0.11	0.123623	0.51	0.529244	0.91	0.801883	1.31	0.936063
0.12	0.134758	0.52	0.537899	0.92	0.806768	1.32	0.938065
0.13	0.145867	0.53	0.546464	0.93	0.811564	1.33	0.940015
0.14	0.156947	0.54	0.554939	0.94	0.816271	1.34	0.941914
0.15	0.167996	0.55	0.563323	0.95	0.820891	1.35	0.943762
0.16	0.179012	0.56	0.571616	0.96	0.825424	1.36	0.945561
0.17	0.189992	0.57	0.579816	0.97	0.829870	1.37	0.947312
0.18	0.200936	0.58	0.587923	0.98	0.834232	1.38	0.949016
0.19	0.211840	0.59	0.595936	0.99	0.838508	1.39	0.950673
0.20	0.222703	0.60	0.603856	1.00	0.842701	1.40	0.952285
0.21	0.233522	0.61	0.611681	1.01	0.846810	1.41	0.953852
0.22	0.244296	0.62	0.619411	1.02	0.850838	1.42	0.955376
0.23	0.255023	0.63	0.627046	1.03	0.854784	1.43	0.956857
0.24	0.265700	0.64	0.634586	1.04	0.858650	1.44	0.958297
0.25	0.276326	0.65	0.642029	1.05	0.862436	1.45	0.959695
0.26	0.286900	0.66	0.649377	1.06	0.866144	1.46	0.961054
0.27	0.297418	0.67	0.656628	1.07	0.869773	1.47	0.962373
0.28	0.307880	0.68	0.663782	1.08	0.873326	1.48	0.963654
0.29	0.318283	0.69	0.670840	1.09	0.876803	1.49	0.964898
0.30	0.328627	0.70	0.677801	1.10	0.880205	1.50	0.966105
0.31	0.338908	0.71	0.684666	1.11	0.883533	1.51	0.967277
0.32	0.349126	0.72	0.691433	1.12	0.886788	1.52	0.968413
0.33	0.359279	0.73	0.698104	1.13	0.889971	1.53	0.969516
0.34	0.369365	0.74	0.704678	1.14	0.893082	1.54	0.970586
0.35	0.379382	0.75	0.711156	1.15	0.896124	1.55	0.971623
0.36	0.389330	0.76	0.717537	1.16	0.899096	1.56	0.972628
0.37	0.399206	0.77	0.723822	1.17	0.902000	1.57	0.973603
0.38	0.409009	0.78	0.730010	1.18	0.904837	1.58	0.974547
0.39	0.418739	0.79	0.736103	1.19	0.907608	1.59	0.975462

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TABLE Q3 (c) (continue)

x	erf x	x	erf x	x	erf x	x	erf x
		2.09 ...		2.59 ...		3.09 ...	
1.60	0.976348	2.10	0.997021	2.60	0.999764	3.10	0.99998835
1.61	0.977207	2.11	0.997155	2.61	0.999777	3.11	0.99998908
1.62	0.978038	2.12	0.997284	2.62	0.999789	3.12	0.99998977
1.63	0.978843	2.13	0.997407	2.63	0.999800	3.13	0.99999042
1.64	0.979622	2.14	0.997525	2.64	0.999811	3.14	0.99999103
1.65	0.980376	2.15	0.997639	2.65	0.999822	3.15	0.99999160
1.66	0.981105	2.16	0.997747	2.66	0.999831	3.16	0.99999214
1.67	0.981810	2.17	0.997851	2.67	0.999841	3.17	0.99999264
1.68	0.982493	2.18	0.997951	2.68	0.999849	3.18	0.99999311
1.69	0.983153	2.19	0.998046	2.69	0.999858	3.19	0.99999356
1.70	0.983790	2.20	0.998137	2.70	0.999866	3.20	0.99999397
1.71	0.984407	2.21	0.998224	2.71	0.999873	3.21	0.99999436
1.72	0.985003	2.22	0.998308	2.72	0.999880	3.22	0.99999473
1.73	0.985578	2.23	0.998388	2.73	0.999887	3.23	0.99999507
1.74	0.986135	2.24	0.998464	2.74	0.999893	3.24	0.99999540
1.75	0.986672	2.25	0.998537	2.75	0.999899	3.25	0.99999570
1.76	0.987190	2.26	0.998607	2.76	0.999905	3.26	0.99999598
1.77	0.987691	2.27	0.998674	2.77	0.999910	3.27	0.99999624
1.78	0.988174	2.28	0.998738	2.78	0.999916	3.28	0.99999649
1.79	0.988641	2.29	0.998799	2.79	0.999920	3.29	0.99999672
1.80	0.989091	2.30	0.998857	2.80	0.999925	3.30	0.99999694
1.81	0.989525	2.31	0.998912	2.81	0.999929	3.31	0.99999715
1.82	0.989943	2.32	0.998966	2.82	0.999933	3.32	0.99999734
1.83	0.990347	2.33	0.999016	2.83	0.999937	3.33	0.99999751
1.84	0.990736	2.34	0.999065	2.84	0.999941	3.34	0.99999768
1.85	0.991111	2.35	0.999111	2.85	0.999944	3.35	0.999997838
1.86	0.991472	2.36	0.999155	2.86	0.999948	3.36	0.999997983
1.87	0.991821	2.37	0.999197	2.87	0.999951	3.37	0.999998120
1.88	0.992156	2.38	0.999237	2.88	0.999954	3.38	0.999998247
1.89	0.992479	2.39	0.999275	2.89	0.999956	3.39	0.999998367
1.90	0.992790	2.40	0.999311	2.90	0.999959	3.40	0.999998478
1.91	0.993090	2.41	0.999346	2.91	0.999961	3.41	0.999998582
1.92	0.993378	2.42	0.999379	2.92	0.999964	3.42	0.999998679
1.93	0.993656	2.43	0.999411	2.93	0.999966	3.43	0.999998770
1.94	0.993923	2.44	0.999441	2.94	0.999968	3.44	0.999998855
1.95	0.994179	2.45	0.999469	2.95	0.999970	3.45	0.999998934
1.96	0.994426	2.46	0.999497	2.96	0.999972	3.46	0.999999008
1.97	0.994664	2.47	0.999523	2.97	0.999973	3.47	0.999999077
1.98	0.994892	2.48	0.999547	2.98	0.999975	3.48	0.999999141
1.99	0.995111	2.49	0.999571	2.99	0.999977	3.49	0.999999201
2.00	0.995322	2.50	0.999593	3.00	0.99997791	3.50	0.999999257
2.01	0.995525	2.51	0.999614	3.01	0.99997926	3.51	0.999999309
2.02	0.995719	2.52	0.999635	3.02	0.99998053	3.52	0.999999358
2.03	0.995906	2.53	0.999654	3.03	0.99998173	3.53	0.999999403
2.04	0.996086	2.54	0.999672	3.04	0.99998286	3.54	0.999999445
2.05	0.996258	2.55	0.999689	3.05	0.99998392	3.55	0.999999485
2.06	0.996423	2.56	0.999706	3.06	0.99998492	3.56	0.999999521
2.07	0.996582	2.57	0.999722	3.07	0.99998586	3.57	0.999999555
2.08	0.996734	2.58	0.999736	3.08	0.99998674	3.58	0.999999587
2.09	0.996880	2.59	0.999751	3.09	0.99998757	3.59	0.999999617

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TABLE Q5(a)

Character	F	K	E	E	U	T	H	M
ASCII								

TABLE Q5(a)

Bits	5	0	1	0	1	0	1	0	1
	6	0	0	1	1	0	0	1	1
1 2 3 4	7	0	0	0	0	1	1	1	1
0 0 0 0		NUL	DLE	SP	0	@	P	`	p
1 0 0 0		SOH	DC1	!	1	A	Q	a	q
0 1 0 0		STX	DC2	"	2	B	R	b	r
1 1 0 0		ETX	DC3	#	3	C	S	c	s
0 0 1 0		EOT	DC4	$	4	D	T	d	t
1 0 1 0		ENQ	NAK	%	5	E	U	e	u
0 1 1 0		ACK	SYN	&	6	F	V	f	v
1 1 1 0		BEL	ETB	'	7	G	W	g	w
0 0 0 1		BS	CAN	(	8	H	X	h	x
1 0 0 1		HT	EM	)	9	I	Y	i	y
0 1 0 1		LF	SUB	*	:	J	Z	j	z
1 1 0 1		VT	ESC	+	;	K	[	k	{
0 0 1 1		FF	FS	,	<	L	\	l		
1 0 1 1		CR	GS	-	=	M	]	m	}
0 1 1 1		SO	RS	.	>	N	^	n	~
1 1 1 1		SI	US	/	?	O	_	o	DEL

NUL Null, or all zeros
SOH Start of heading
STX Start of text
ETX End of text
EOT End of transmission
ENQ Enquiry
ACK Acknowledge
BEL Bell, or alarm
BS Backspace
HT Horizontal tabulation
LF Line feed
VT Vertical tabulation
FF Form feed
CR Carriage return
SO Shift out
SI Shift in
DLE Data link escape

DC1 Device control 1
DC2 Device control 2
DC3 Device control 3
DC4 Device control 4
NAK Negative acknowledge
SYN Synchronous idle
ETB End of transmission
CAN Cancel
EM End of medium
SUB Substitute
ESC Escape
FS File separator
GS Group separator
RS Record separator
US Unit separator
SP Space
DEL Delete