NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

BACHELOR OF ENGINEERING (HONS) DEGREE

Final examinations
May   2013

TEE 3221   **Digital Communications Engineering**

Duration of Examination 3 Hours

Instructions to candidates:
1. Answer any <u>five</u> questions only.
2. Each question carries equal marks.
3. Draw all your diagrams and circuits clearly.
4. Start the answers for the new question on a fresh page.

QUESTION 1

It is required to transmit the word 'THINK' using an 8-ary system.
a) Encode it into a sequence of bits using a 7-bit ASCII coding. How many total bits are there in the message?   [6]

b) Partition the bit stream into $k = 3$ bit segments. Represent each of the 3-bit segments as an octal number (symbol). How many octal symbols are there in the message?   [6]

c) If the system was designed with 16-ary modulation, how many symbols would be used to represent the message?   [4]

d) If the system was designed with 256-ary modulation, how many symbols would be used to represent the message?   [4]

QUESTION 2

a) Explain uniform and non-uniform quantization. When is each type of quantization most appropriate?   [15]

b) What is aliasing? What is the roll of aliasing in signal transmission?   [5]

QUESTION 3

Draw the typical digital communications system diagram and explain the functions of each block in detail.   [20]

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QUESTION 4

a) Explain formatting and transmission of baseband signals by drawing a suitable diagram. [12]

b) The analog signal recovered from the sampled, quantized and transmitted pulses will contain corruption from several sources. Describe these sources in detail. [8]

QUESTION 5

a) Briefly discuss types of Pulse Amplitude Modulation (PAM). [18]

b) Draw the block diagram of an analogue Time Division Multiplex (TDM) system. [2]

QUESTION 6

Explain the methods of Spread Spectrum (SS) modulation. What are the benefits of transmitting a signal by spread spectrum (SS) modulation? [20]

QUESTION 7

a) Explain the Synchronous Digital Hierarchy (SDH) frame structures. [16]

b) Name the basic Asynchronous Transfer Mode (ATM) layers. [4]

QUESTION 8

a) Explain with the aid of the diagram the principle of E1 First-order TDM system. [10]

b) Show the structure of E1 frame using the diagram. [10]

End of the paper

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	DC1	Device control 1
SOH	Start of heading	DC2	Device control 2
STX	Start of text	DC3	Device control 3
ETX	End of text	DC4	Device control 4
EOT	End of transmission	NAK	Negative acknowledge
ENQ	Enquiry	SYN	Synchronous idle
ACK	Acknowledge	ETB	End of transmission block
BEL	Bell, or alarm	CAN	Cancel
BS	Backspace	EM	End of medium
HT	Horizontal tabulation	SUB	Substitute
LF	Line feed	ESC	Escape
VT	Vertical tabulation	FS	File separator
FF	Form feed	GS	Group separator
CR	Carriage return	RS	Record separator
SO	Shift out	US	Unit separator
SI	Shift in	SP	Space
DLE	Data link escape	DEL	Delete