**INSTITUTE OF AERONAUTICAL ENGINEERING** 

(Autonomous) Dundigal, Hyderabad - 500 043

## **ELECTRONICS AND COMMUNICATION ENGINEERING**

## **ASSIGNMENT QUESTIONS**

Course Name	DIGITAL COMMUNICATIONS			
Course Code	A60420			
Course Structure	Lectures	Tutorials	Practicals	Total
	4	1	-	5
Course Coordinator	Dr. P. G. Krishna Mohan, Professor, ECE Dept			
Course Faculty	Dr. P. G. Krishna Mohan, Professor, ECE Dept			
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## **OBJECTIVES**

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

ASSIGNMENT I			
UNIT I			
ELEN	IENTS OF DIGITAL COMMUNICATION SYSTEMS PULS	SE CODE MODU	JLATION
S. No.	Questions	Blooms Taxonomy Level	Course Outcome
1	Explain the different types of Sampling.	Remember	1
2	Distinguish between natural sampling and flat top sampling with neat schematics, listing out their merits and demerits.	Remember	2
3	Explain Bandwidth-S/N Tradeoff	Remember	4
4	Define Nyquist Sampling theorem.	Remember	3
5	Explain the Model of Digital Communication Systems with neat diagrams.	Understand	5
6	Construct the equation for Shannon limit on Information capacity.	Remember	5
7	Construct the mathematical expression for Minimum sampling rate (fs).	Remember	8
8	Examine Aliasing Effect (or) Fold-over distortion? How it can be removed.	Understand	1
9	Explain the principle of working a sample and hold circuit. List out its applications with neat diagrams.	Remember	2
10	Discuss memorysegmentation &mention its advantages.	Remember	4
11	Discuss the advantages and disadvantages of digital communication system.	Remember	3



12	Estimate Nyquist rate and Nyquist interval for the signal 10	Understand	5
	$\cos (2000\pi t)\cos (4000\pi t)$ based on Low pass sampling theory		
13	Solve the Nyquist rate and Nyquist intervals for each of the	Understand	5
	following signals		
	i) $x(t)=Sinc200t$		
	ii) $x(t)$ =Sinc200t		
	111)x(t) = Sinc200t + Sinc200t.		
14	The terminal of a computer used to enter alphanumeric data is	Remember	8
	connected to the computer through a voice grade telephone		
	line having a usable bandwidth of 3KHz and a output		
1.7	SNR010 dB. Determine the capacity of the channel.		1
15	For a DM system, signal sampled at $76$ KHz and Amax = 4	Understand	1
	(a)Assuming that the signal is sinusoidal determine output		
	signal power & SNR.		
	(b)Determine the minimum transmission band width? Derive		
16	The invest to the DCM constant is $w(t) = 10 \cos 2 - \sin 10.4t$ the	The dependence of	2
10	The input to the PCW system is $m(t) = 100032\pi \times 1041$ , the	Understand	2
	signal is sampled at hyprist rate, each sample is encoded in		
	i) Bit rate ii) Bandwidth iii) Signal to Noise ratio		
17	The input to the DM is $m(t)=8\sin 2\pi x 10/t$ . The step size	Understand	1
17	$\delta = 0.314$ yolts Determine the bit rate	Understand	1
18	Explain the Block diagram of DPCM system	Remember	2
10	Elaborate how to avoid slope overload distortion in DM	Remember	4
20	Illustrate the working of Adaptive DPCM with the help of	Remember	3
20	diagram.	remember	5
21	Illustrate the working of Adaptive DM with the help of	Remember	5
	diagram.		_
22	Explain the Companding.	Remember	5
23	A TV signal with a bandwidth of 4.2MHz is transmitted using	Remember	8
	PCM with 512 quantization levels. Solve binary word code		
	length and transmitted bit rate.		
24	The input to the delta modulator is $m(t)=5t$ and sampling rate	Understand	1
	is 5000 samples/sec. Determine the step size.		
25	Define quantization noise power	Remember	2
26	Discuss about uniform quantization?	Remember	4
	UNIT II		
	DIGITAL MODULATION TECHNIQUE	ES	
		Blooms	Course
S. No.	Questions	Taxonomy	Outcome
		Level	outcome
1	Explain in detail about	Remember	5
	1. FSK		
2	II. PSK with waveforms and equations	Damanhan	0
2	b) ASK b) DSK systems	Remember	8
3	a) ASK 0) FSK Systems. What are eve pattern?	Pamamhar	1
4	Explain Optimum Receiver	Remember	2
- <del>-</del> 5	Explain Optimum Receiver.	Remember	<u>2</u> <u>A</u>
6	Estimate the hand width required for frequency shift keying	Remember	3
	and draw its spectrum.	Kennennoer	5
7	Explain non coherent detection of Amplitude shift keving	Remember	5
8	Construct the constellation diagram for Ouadrature phase shift	Remember	5
	keying.		

9	Explain coherent detection of frequency shift keying .what should be the relationship between bit rate and frequency shift	Remember	8
	for a better performance?		
10	Explain Differential phase shift keying modulation with neat block diagram. Draw the wave forms.	Remember	1
11	Show that the probability of error for phase shift keying is $Pe= O(2Say Tb/N0)1/2$ and the threshold level is zero.	Understand	2
12	The bit stream 11011100101 is to be transmitted using DPSK.	Understand	4
	sequence.		
13	Explain the working of DPSK modulator and demodulator.	Remember	3
	UNIT III		
	BASE BAND TRANSMISSION AND OPTIMAL RECEPT	ION OF DIGIT	<b>AL</b>
	SIGNAL INFORMATION THEORY		
		Blooms	Course
S. No.	Questions	Taxonomy	Outcome
1	Why equalization is necessary in Baseband transmission?	Level Pemember	8
1	Give the block diagram of adaptive filter and explain about	Kemenibei	0
	each element.		
2	Explain the base band transmission of M-ary data with suitable diagrams.	Remember	1
3	What is matched filter? Derive the expression for its output SNR.	Remember	2
4	a) What is an inter symbol interference in baseband binary	Understand	4
	PAM system? Explain.		
	b) Give the basic components of a filter in baseband data		
5	transmission and explain.	Domomhan	2
5	A certain telephone line bandwidth is 4 KHZ. Calculate the data rate in hos that can be transmitted if we use hinary	Remember	3
	signaling with raised cosine pulses and a roll off factor		
	α=0.25.		
6	In a certain telemetry system, eight message signals having 2	Understand	5
	kHz bandwidth each are time division multiplexed using a		
	binary PCM Technique .the error in sampling amplitude		
	cannot be greater than 1% of the peak amplitude. Determine		
	the minimum transmission bandwidth required in raised cosine pulses with roll off factor $\alpha = 0.2$ are used the		
	rate must be at least 25% above the Nyquist rate		
	A telephone line of bandwidth 4Khz required to transmit data		
	at 6kbps using raised cosine pulses. Determine the roll of		
	factor a		
7	Explain Pulse Shaping for Optimum Transmission.	Remember	5
8	Explain A Baseband Signal Receiver.	Remember	8
9	Explain Optimum Receiver	Remember	1
10	Examine Crosstalk.	Remember	2
11	Explain Optimum Receiver.	Linderstand	
12	Explain Signal Space Representation. What does the width of the eve define?	Remember	<u> </u>
14	Why equalization is necessary in Reschand transmission?	Remember	5
1-1	Give the block diagram of adaptive filter and explain about	i comenio ei	5
	each element.		
15	Explain the base band transmission of M-ary data with	Understand	5
	suitable diagrams.		

16	What is matched filter? Derive the expression for its output	Understand	5
	ASSIGNMENT II		
	BASE BAND TRANSMISSION AND OPTIMAL RECEPT	TION OF DIGITA	L
	SIGNAL INFORMATION THEORY		
C N-	Ormetiana	Blooms	Course
<b>5.</b> INO.	Questions	Level	Outcome
1	State the properties of Entropy.	Remember	5
2	What is discrete memory less channel and give the channel	Understand	8
2	matrix expression.		
3	source coding theorem?	Remember	1
4	What is entropy? Show that the entropy is maximum when all	Damarchan	2
	the symbols are equi probable. Assume M=2.	Kemember	2
5	Show that the mutual information of a channel is related to the joint entropy of the channel input and channel output	Remember	4
6	Explain Shannon-fano coding algorithm using an example	Understand	3
7	Explain the Huffman coding algorithm using an example.	Remember	5
8	Explain the Conditional Entropy.	Remember	5
9	Explain the Redundancy.	Remember	8
10	A voice signal is sampled at the rate of 5000samples/sec and	Understand	1
	each sample is encoded into 5-bits using PCM system. The		
	binary data is transmitted into free space after modulation.		
	Determine the bandwidth of the modulated signal, if the		
	modulation used is		
	a) ASK b) PSK c) FSK		
11	where f1=8MHz and f2=6MHz.	The demotent	2
11	Binary data is transmitted over an RF band pass channel with	Understand	2
	a usable ballowidth of 1000Hz at a rate of 4.8x1000hs/sec		
	receiver antenna is 1mV and noise power spectral density at		
	the receiver input is 10-15Watt/Hz Determine the error		
	probability of a coherent receiver.		
12	Assume that 4800 bits/sec random data are sent over band	Remember	5
	pass channel by using the following schemes:		
	a) BPSK		
	b) FSK		
	Determine the Transmission bandwidth.		
	UNIT-IV		_ ~
	LINEAR BLOCK CODES, CYCLIC CODES & CONVOL	LUTIONAL COD	ES
S No	Questions	Blooms	Course
<b>5.</b> INU.	Questions	Level	Outcome
1	The polynomial $x^{15}+1$ when factored gives	Understand	2
	$x^{15}+1=(x^{4}+x^{3}+1)(x^{4}+x^{3}+x^{2}+x+1)(x^{4}+x+1)(x^{2}+x+1)(x^{4}+$		
	a) Construct a systematic (15,5)code using the generator		
	polynomial $g(x) = (x4+x3+x2+x+1)(x4+x+1)(x4+x3+1)(x+1)$		
	b) What is the minimum distance of the code?		
	c) How many random errors per code word can be corrected?		
2	The generator polynomial of a (7, 4) cyclic code is $g(x) =$	Understand	4
	1+x+x <sup>2</sup> . Find the 16 code words of this code:		
	a) By forming the code polynomials using $v(x) = D(x)g(x)$ ,		

	where D(x)is the message polynomial.		
	b) Draw the encoder block diagram?		
3	For a (6,3) systematic linear block code the three parity check	Understand	3
	bits c4, c5, c6 are formed from the following equations:		
	c4=d1 (xor) $d3$ ; $c5=d1$ (xor) $d2$ (xor) $d3$ ; $c6=d1$ (xor) $d2$ .		
	a) Write down the generator matrix G		
	b) Suppose that the received word is 010111. Decode this		
	received word by finding the location of the error and the		
	transmitted data bit		
4	For a (6, 3) systematic linear block code, the three parity	Understand	5
	check bits c4, c5, c6 are formed from the following		
	equations.		
	C4=d1+d3		
	C5 = d1 + d2 + d3		
	C6=d1+d2		
	a) Construct the generator matrix G.		
	b) Construct all possible code words.		
5	$\int C_{\text{onsider the }}(\mathbf{R}, \mathbf{A})$ linear block and with $C_{-}$	Domomhor	5
5	Consider the $(8,4)$ linear block code with G=	Keineinder	5
	000100011		
	(a) Construct all the possible code words		
	(a) Construct all the single error patterns		
6	(b) Construct an the single error patterns.	Domomhor	0
	Analyze and prove the fundamental properties of cyclic code. Show that if $a_i$ and $a_i$ are two and vectors in an $(n, k)$ linear	Remember	0
/	block code then their sum is also a code vector	Kemember	1
8	The generator polynomial of $(15.11)$ cyclic code is $g(x)$ -	Understand	2
0	1+x+x4 Determine the parity polynomial $h(x)$ of this code	Onderstand	2
9	What is parity check matrix and how it is used?	Remember	5
10	Explain systematic cyclic code generation formula	Remember	8
11	What are the conditions to satisfy the hamming code?	Remember	1
12	Define code word & block length.	Understand	2
13	Construct the graphical representations of convolutional	Understand	4
10	codes.	Chachstand	
14	Construct the encoding diagram for (3, 2, 1) convolutional	Remember	3
	encoder.		-
15	What is sequential decoding?	Remember	5
16	Explain about the Convolutional interleaving.	Remember	5
17	What is meant by random errors and burst errors? Explain	Remember	8
	about a coding technique which can be used to correct both		
	the burst and random errors simultaneously.		
18	Discuss about the various decoders for convolutional codes.	Remember	1
19	Explain how the channel coding reduces the probability of	Remember	2
	error.		
20	Explain the systematic code form for the binary cyclic codes?	Remember	5
21	Explain about block codes in which each block of k message	Understand	8
	bits encoded into block of <b>n&gt;k</b> bits with an example.		
22	Demonstrate the Viterbi algorithm for maximum-likelihood	Understand	1
	decoding of convolutional codes.		
23	Consider the (3,1,2) nonsystematic convolution encoder with	Understand	2
	$g^{(0)} = (1 \ 1 \ 0) \ g^{(1)} = (1 \ 0 \ 1) \ g^{(2)} = (1 \ 1 \ 1)$ What the generator		
	$a_{1} = (1, 1, 1), a_{2} = (1, 1, 1), a_{1} = (1, 1, 1), a_{1} = (1, 1, 1), a_{2} = (1, 1, 1), a_{1} = (1, 1, 1), a_{2} = (1, 1, 1), a_{1} = (1, 1, 1), a_{2} = (1, 1, 1), a_{1} = (1, 1, 1), a_{2} = (1, 1, 1), a_{1} = (1, 1, 1), a_{2} = (1,$		
	math for the code.		

24	Consider the (3,1,2) nonsystematic convolution encoder with	Remember	4
	$g^{(0)} = (1, 1, 0), g^{(1)} = (1, 0, 1), g^{(2)} = (0, 1, 1)$ . Find the constraint		
	length and the rate efficiency of the code.		
25	Find the code word for data word 1110 in a (7,4) cyclic code	Remember	3
	using the generator polynomial $g(x)=1+x^2+x^3$ using		
	encoder.		
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		т	
	SPREAD SPECTRUM MODULATION	N	
		Blooms	Course
S. No.	Questions	Taxonomy	Outcome
		Level	Outcome
1	a) Explain how PN sequences are generated. What are	Remember	8
	maximal-length sequences? What are their properties and why		
	are they preferred?		
	b) with the help of a neat block diagram, explain the working		
2	of a DS spread spectrum based CDMA system.	D	2
2	compare direct sequence spread spectrum and frequency	Remember	2
	footures of each		
3	a) What the PN sequences? Discuss the characteristics	Pemember	5
5	a) What the TN sequences: Discuss the characteristics. b) What are the two basic types of spread-spectrums systems?	Kemember	5
	Explain the basic principle of each of them		
4	Explain the spread spectrum modulation	Understand	8
5	Explain the frequency hopping spread spectrum modulation.	Remember	1
6	Examine spread spectrum modulation using DSSS.	Remember	4
7	Explain the spread spectrum modulation.	Remember	3
8	Define frequency hopping. Explain frequency hopping in	Understand	5
_	detail.		_
9	What are the Advantages of DS-SS systems?	Understand	5
10	What are the Disadvantages of DS-SS systems?	Remember	8
11	List the Advantages of FH-SS System	Remember	1
12	List the Disadvantages of FH-SS System	Remember	2

## **Prepared by:**

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