

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous) Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	DIGITAL COMMUNICATIONS
Course Code	:	A60420
Class	:	III - B. Tech
Branch	:	ECE
Year	:	2017–2018
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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.

MID TERM I					
EI	UNIT-I ELEMENTS OF DIGITAL COMMUNICATION SYSTEMS PULSE CODE MODULATION				
PART	A(Short Answer Questions)				
S.No	Questions	Blooms Taxonomy Level	Course Outcome		
1	Explain the simplified Block diagram of an Electronic communication system.	Understand	1		
2	List two examples each for analog and digital signals (in mathematical form).	Remember	2		
3	Construct the equation for Shannon limit on Information capacity.	Understand	1		
4	Define bandwidth	Understand	1		
5	Define Nyquist rate of Sampling	Understand	1		
6	Explain Shannon & Hartley's Law.	Understand	1		
7	Explain about trade-off between bandwidth and SNR in a communication signal.	Understand	1		

8	Construct the mathematical expression for Minimum sampling rate(fs).	Remember	1
9	Examine Aliasing Effect (or) Fold-over distortion? How it can be removed.	Understand	2
10	List the advantages of digital communication systems	Understand	1
11	Summarize differential encoding signaling? Explain with an example.	Understand	1
12	Define quantization in PCM.	Remember	2
13	Explain a simple model of nonuniform qunatizer.	Understand	3
14	Define the term quantization noise.	Remember	3
15	Compare the features of PCM and DPCM.	Remember	3
16	List the advantage gained by the use of robust quantization.	Understand	3
17	Define an output signal-to-quantization ratio.	Remember	3
18	Mention two major sources of noise which influence the performance of a PCM system.	Understand	2
19	Discuss the advantages of DM over PCM.	Understand	1
20	Construct the block diagram of pulse code modulation.	Understand	2
21	Define quantization noise power	Remember	1
22	Discuss about uniform quantization?	Understand	2
23	Discuss about Quantization?	Remember	2
24	Compare uniform and non-uniform quantization	Remember	3
25	Discuss channel coding theorem?	Remember	3
26	List out the advantages of ADM over DM.	Remember	3
27	List out the advantages of DPCM over PCM.	Remember	1
28	Define Sampling	Remember	2
29	Define the bandwidth of PCM	Remember	3
30	Define the bandwidth of ADM	Remember	3
PART	B (Long Answer Questions)	DI	
S.No	Questions	Taxonomy Level	Course Outcome
1.	Explain the different types of Sampling.	Remember	2
2.	Distinguish between natural sampling and flat top sampling with neat schematics, listing out their merits and demerits.	Understand	2
3.	Explain the principle of working a sample and hold circuit. List out its applications with neat diagrams.	Remember	2
4.	Define the sampling theorem as applicable to voice signals on telephone lines.	Understand	2
5.	Discuss the advantages and disadvantages of digital communication system.	Remember	1
6.	Discuss and prove sampling theorem in time domain.	Remember	2
7.	Definen natural sampling? Explain it with sketches.	Understand	2
8.	Discuss the Hartley-Shannon law in digital communications?	Remember	3
9.	Explain the Model of Digital Communication Systems with neat diagrams.	Understand	1
10.	Explain Bandwidth and Signal to noise ratio Tradeoff	Remember	3
11		Understand	3
	of diagram.	Understand	5
12	Inustrate the working of DPCM transmitter and receiver with the help of diagram. Enumerate the quantization error in delta modulation.	Remember	3

14	Elaborate how to avoid slope overload distortion in DM.	Remember	3
15	Illustrate the working of Adaptive DPCM with the help of diagram.	Understand	3
16	Illustrate the working of Adaptive DM with the help of diagram.	Remember	3
17	Explain the Companding in Adaptive DM	Understand	3
18	Explain	Remember	3
	a)Channel Noise		
10	b) Quantization noise in DM and derive expression for them?	Understand	2
19	communications.	Understand	3
20	Explain the Block diagram of DPCM system.	Remember	3
21	Discuss quantization error? How does it depend upon the step size?	Understand	3
	Suggest some methods to overcome the difficulties encountered		
	depending on the modulating Amplitude swing?		
PART	C(Analytical Questions)		
		Blooms	Course
S.No	Questions	Taxonomy	Outcome
1	Estimate Nyquist rate and Nyquist interval for the signal 10 Cos	Remember	2
1.	$(2000\pi t)$ Cos (4000 πt) based on Low pass sampling theory	Remember	2
2.	A signal m(t)=4 Cos (60 π t) +2 Cos (160 π t) +Cos (280 π t) is sampled	Understand	2
	at150 Hz,75 Hz,300 Hz.Estimate the frequency components of the		
	signal that appear at the output of an ideal LPF with cutoff at 290 Hz.		
	form (t)?		
3.	Solve the Nyquist rate and Nyquist intervals for each of the following	Remember	2
	signals		
	i) $x(t)=Sinc200t$		
	ii)x(t)=Sinc200t		
	iii)x(t) = Sinc200t + Sinc200t.	TT 1 , 1	
4.	The terminal of a computer used to enter alphanumeric data is connected to the computer through a voice grade telephone line having	Understand	2
	a usable bandwidth of 3 KHz and a output SNR of 10 dB. Determine the		
	capacity of the channel.		
5.	A signal $m(t) = 4 \cos (60 \pi t) + 2 \cos (160 \pi t) + \cos (280 \pi t)$ is	Understand	2
	sampled at a) 150 Hz,b) 75 Hz, c) 300 Hz.		
	Determine the frequency components of the signal that appear at the		
	output of an ideal LPF with cut off at 290 Hz. in each case. What is the		
6	A TV signal with a bandwidth of 4.2MHz is transmitted using PCM	Understand	2
0.	with 512 quantization levels. Solve binary word code length and	Understand	2
	transmitted bit rate.		
7.	The input to the delta modulator is $m(t)=5t$ and sampling rate is 5000	Understand	2
	samples/sec. Determine the step size.		
8.	An analog signal is sampled at the Nyquist rate of 20KHz and quantized	Understand	2
	into $L=1024$ levels. Solve the bit rate and the time-duration of one bit of the binary encoded signal		
9	A six hit single channel PCM system gives an output of 60 kilobits per	Understand	3
	second. Determine the highest possible modulating frequency for the	Chicobund	5
	system.		
10.	The input to the delta modulator is 5cos2[1000t. The pulse rate is	Understand	3
1.1	56,000 pulses/sec. Determine the step size		2
11.	An analog signal is sampled at the Nyquist rate of 20KHz and quantized	Remember	3

	into L=1024 levels. Solve the bit rate and the time-duration of one bit		
12	A six hit single channel PCM system gives an output of 60 kilobits per	Remember	3
12.	second. Determine the highest possible modulating frequency for the	Remember	5
	system.		
13.	The input to the delta modulator is 5cos2∏1000t. The pulse rate is	Remember	3
	56,000 pulses/sec. Determine the step size		
14.	A signal m(t) Band limited to 4 kHz is sampled at twice the Nyquist	Remember	3
	rate & its samples transmitting by PCM. An output SNR of 4/ dB is		
	(a) Solve N and minimum value of Si/Ni of operation is to be above		
	threshold		
	(b) Sove minimum system Band width required and find signaling		
	rate needed to achieve the given output SNR.		
15.	A voice frequency signal band limited to 3 KHz is transmitted with the	Understand	3
	use of the DM system. The prf is 30,000 pulses/second and step size is		
	to avoid error		
16.	For a DM system, signal sampled at 76 KHz and Amax = 4	Remember	3
	(a) Assuming that the signal is sinusoidal determine output signal		_
	power & SNR.		
	(b) Determine the minimum transmission Band width? Derive the		
17	relations. The input to the DCM system is $m(t)=10\cos 2\pi v 104t$ the signal is	Understand	2
17.	sampled at nyquist rate each sample is encoded in to 4-bits	Understand	3
	Determine i) Bit rate ii) Bandwidth, iii) Signal to Noise ratio		
18.	The input to the DM is m(t)= $8\sin 2\pi x 104t$. The step size δ =0.314 volts.	Remember	3
	Determine the bit rate.		
	UNIT-II DICITAL MODULATION TECHNIQUES		
DADT	(Short Answer Questions)		
	(Short Answer Questions)	Diaman	
S No	Questions	Blooms	Course
5.110	Questions	Level	Outcome
1.	Construct the ASK waveforms for 011011.	Remember	4
2.	Sketch the block diagram of ASK generation.	Understand	4
3.	Construct the FSK waveforms for 011011.	Remember	4
4.	Show the space representation of BPSK	Understand	4
5.	Explain the Bandwidth, power and energy calculations for PSK signal.	Understand	4
6.	Explain why PSK is always preferable over ASK in coherent detection?	Understand	4
7.	Distinguish between Coherent and Non coherent detection?	Understand	4
8.	Explain Phase shift keying with relevant equations and waveforms.	Understand	4
9.	Estimate the band width required for frequency shift keying	Understand	4
10.	Explain non coherent detection of Amplitude shift keying.	Understand	4
11.	Construct the constellation diagram for Quadrature phase shift keying.	Remember	4
12.	Explain coherent detection of frequency shift keying	Remember	4
13.	Construct the FSK waveforms for a given input data "1101".	Remember	4

15.	Draw FSK spectrum.	Understand	4	
16.	What should be the relationship between bit rate and frequency shift for a better performance?	Remember	4	
17.	Show the space representation of QPSK	Understand	4	
PART B (Long Answer Questions)				
S.No	Questions	Blooms Taxonomy Level	Course Outcome	
1.	Explain in detail about i)FSK ii)PSK with waveforms and equations	Remember	4	
2.	Determine probability of error for a) ASK and b) PSK systems.	Understand	4	
3.	a) Explain the demodulation of FSK using coherent detection.b) Draw the block diagram of QPSK receiver.	Remember	4	
4.	Explain the generation of PSK signals.	Understand	4	
5.	a) Discuss QPSK signaling.b) Derive the bit error probability due to PSK receiver.	Remember	4	
6.	Solve that the maximum output signal to noise ratio of a matched filter is $(SNR) = 2E/N0$	Understand	4	
7.	Explain Differential phase shift keying modulation with neat block diagram. Draw the wave forms.	Remember	4	
8.	Show that the probability of error for phase shift keying is $Pe= Q(2Sav Tb/N0)1/2$ and the threshold level is zero.	Remember	4	
9.	The bit stream 11011100101 is to be transmitted using DPSK. Determine the encoded sequence and the transmitted phase sequence.	Understand	4	
10.	Explain the working of DPSK modulator and demodulator.	Remember	4	
PART	C(Analytical Questions)			
S.No	Questions	Blooms Taxonomy Level	Course Outcome	
1.	For the signals, the given bit rate is 10Kbps. Estimate the bandwidth for ASK and FSK signals.	Remember	4	
2.	Assume that 3600 bits/sec data is sent over a pass band channel by FSK signaling scheme. Estimate the transmission bandwidth.	Understand	4	
3.	A voice signal is sampled at the rate of 5000samples/sec and 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 where f1=8MHz and f2=6MHz.	Remember	4	
4.	Binary data is transmitted over an RF band pass channel with a usable bandwidth of 10MHz at a rate of 4.8x106bits/sec using an ASK signaling method. The carrier amplitude at the 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.	Understand	4	
5	Assume that 4800 bits/sec random data are sent over band pass channel by using the following schemes: A) BPSK b) FSK Determine the Transmission bandwidth.	Remember	4	

UNIT-III BASE BAND TRANSMISSION AND OPTIMAL RECEPTION OF DIGITAL SIGNAL			
PART	INFORMATION THEORY		
S.No	Questions	Blooms Taxonomy Level	Course Outcome
1.	What is a matched filter?	Remember	5
2.	List two applications for eye pattern.	Understand	5
3.	What are eye pattern?	Remember	5
4.	Discuss the performance of data transmission system using eye pattern technique?	Understand	5
5.	Discuss the need of optimum transmitting	Understand	5
6.	What is the value of maximum signal to noise ratio of the matched filter? When it becomes maximum?	Understand	5
7.	Construct the block diagram of Base band System.	Understand	5
8.	Examine Crosstalk.	Understand	5
9.	Explain Optimum Receiver.	Understand	5
10.	Explain Signal Space Representation.	Understand	5
11.	What does the width of the eye define?	Remember	5
12.	Make use of the eye pattern and how the sensitivity on the system can be determined?	Remember	5
13.	What is meant by distortion less transmission?	Remember	5
14.	Discuss entropy and give the expression for it.	Remember	5
15.	Explain the channel capacity theorem.	Understand	5
	MID TERM II		
1.	Let X represents the outcome of a single roll of a fair die. What is the entropy of X?	Remember	6
2.	What is transition probability and when it does it will occur?	Understand	6
3.	Explain the two properties of Mutual information.	Understand	6
4.	State the properties of Entropy	Understand	6
5.	What is discrete memory less channel and give the channel matrix expression	Understand	6
6.	What is channel coding theorem	Understand	6
7.	Show that the entropy is maximum when all the symbols are equiprobable. Assume $M=2$.	Remember	6
8	Define information.	Understand	6
9	What is meant by distortion less transmission?	Understand	6
10	What is pass band system	Understand	6
11	How channel coding theorem is different from source coding theorem?	Understand	6
12	Show that information contained by a symbol is inversely proportional to the probability of that symbol.	Understand	6
13	Discuss the need of receiving filter in baseband data transmission.	Remember	6
14	What is Base band System.	Understand	6

15	Examine how does pulse shaping reduce inter symbol interference?	Understand	6	
PART B (Long Answer Questions)				
S.No	Questions	Blooms Taxonomy Level	Course Outcome	
1	Explain Pulse Shaping for Optimum Transmission.	Remember	5	
2	Explain a Baseband Signal Receiver.	Understand	5	
3	Explain Optimum Receiver	Understand	5	
4	Explain Optimal of Coherent Reception	Understand	5	
5	Explain Signal Space Representation	Understand	5	
6	With Neat diagram, explain Eye Diagrams	Understand	5	
7	Explain Cross Talk which occurs in channel?	Remember	5	
8	Why equalization is necessary in Baseband transmission? Give the block diagram of adaptive filter and explain about each element.	Remember	5	
9	Explain the base band transmission of M-ary data with suitable diagrams.	Understand	5	
10	What is matched filter? Derive the expression for its output SNR.	Understand	5	
11	a) What is an inter symbol interference in baseband binary PAM system?Explain.b) Give the basic components of a filter in baseband data transmission and explain.	Understand	5	
	MID TERM II			
1.	Explain Pulse Shaping for Optimum Transmission.	Understand	6	
2.	Show that the entropy for a discrete source is a maximum when the output symbols are equally probable.	Understand	6	
3.	Show that the mutual information of a channel is related to the joint entropy of the channel input and channel output.	Understand	6	
4.	Explain Shannon-fano coding algorithm using an example.	Remember	6	
5.	Explain the Huffman coding algorithm using an example.	Remember	6	
6.	Explain the Conditional Entropy.	Understand	6	
7.	Explain the Redundancy.	Remember	6	
8.	Explain the Mutual Information	Understand	6	
PART	C(Analytical Questions)			
S.No	Questions	Blooms Taxonomy Level	Course Outcome	
1.	A certain telephone line bandwidth is 4 KHz. Calculate the data rate in bps that can be transmitted if we use binary signaling with raised cosine pulses and a roll off factor α =0.25.	Remember	5	
2.	In a certain telemetry system, eight message signals having 2 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 if raised cosine pulses with roll off factor α =0.2 are used the sampling rate must be at least 25% above the Nyquist rate.	Remember	5	
3.	A telephone line of bandwidth 4Knz required to transmit data at 6kbps using raised cosine pulses. Determine the roll of factor α	Understand	5	

4.	The unequalized pulse in a PAM system has the following values at	Remember	5
	sampling times:		
	pr(kTb) = pr(k) = 8 < 0.2 k = 1		
	0.8 k = 0.2 k = -1		
	pr(k) = 0 for $ k > 1$		
	Design a three-tap zero forcing equalizer so that the equalizer output is		
	1 at k = 0		
	and 0 at $k=+1$		
	Calculate Peg(k) for $k=\pm 2,\pm 3$.		
5.	Consider a discrete memory less source with source alphabet $S = \{s_0, s_1\}$		5
5.	solution of a disorder function of $\{0, 0, 1, 0$	Understand	5
6	An event has six possible outcomes with the probabilities $P_1 - \frac{1}{2}$ $P_2 - \frac{1}{4}$	Remember	5
0.	$P_3 = 1/8$ $P_4 = 1/16$ $P_5 = 1/32$ $p_6 = 1/32$ What is the entropy of the	Remember	5
	15 = 1/8, 14 = 1/10, 15 = 1/52, p0 = 1/52. What is the entropy of the evetem?		
7	System: A DMS V has 4 symbols $x_1 + x_2 + x_3 + x_4$ with $p(x_1) = 1/2$, $p(x_2) = 1/4$		5
7.	A DIVIS A has 4 symbols x1, x2, x5, x4 with $p(x1) = 1/2$, $p(x2) = 1/4$, $p(x2) = 1/9 = r(x4)$ Construct Shannon forwards Denset for the Uluffman	Understand	5
	$p(x_3) = 1/8 - p(x_4)$. Construct Shannon-ranocode. Repeat for the Humilian	Understand	
1	Consider the binary symmetric channel. Let P0 denote the probability of	Remember	6
	choosing binary symbol $X0=0$ and let $P1 = 1 - P0$ denote the probability		
	of choosing binary symbol X1=1. Let p denote the transition probability		
	of the channel. Calculate the average mutual information between the		
	channel input and channel output.		
2	A source emits one of four possible symbols during each signaling		6
	interval. The symbols occur with the probabilities. $p_{1}=0.4$, $p_{2}=0.3$,	TT 1 / 1	
	p3=0.2, p4=0.1. Estimate the information gained by observing the source	Understand	
	emitting each of these symbols.		
3	a) A source emits one of 4 symbols s0, s1, s2, s3 with probabilities	Remember	6
	1/3, $1/6$, $1/4$, $1/4$ respectively. The successive symbols emitted by the		_
	source are statistically independent. Calculate the entropy of the source.		
	b) Derive the channel capacity theorem for discrete channels		
4	A source emits one of the four possible messages m1 m2 m3 m4 with		6
-	the probabilities $\frac{1}{2}$ 1/4 1/8 1/8 respectively. Calculate the information	Understand	Ŭ
	content of each message and average information per message	Onderstand	
5	A source emits an independent sequence of symbols from an alphabet	Pamamhar	6
5	A source entries an independent sequence of symbols from an applabet consisting of five symbols $A \cap B \cap C$ D and E with symbol probabilities	Kemeniber	0
	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{2}{16}$ $\frac{5}{16}$ respectively. What is the entropy of the source?		
6	A discrete course smith one of five symbols once every millissond. The		6
0	A discrete source entries one of five symbols once every minisecond. The symbol probabilities are $\frac{1}{16}$ $\frac{1}{16}$ $\frac{1}{16}$ respectively. What is the	Understand	0
	symbol probabilities are 72, 74, 1/6, 1/10, 1/10 respectively. What is the	Understand	
7	Source entropy and information rate:		C
/	Esumate the entropy of a source that emits one of three symbols A,B, C	Damesult	0
	In a statically independent sequence with probabilities $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{4}$	Kemember	
	respectively.		
	UNIT-IV	NAL CODES	
DADT	LINEAR BLOCK CODES, CICLIC CODES & CONVOLUTIO	AL CODES	
PART	A(Short Answer Questions)		1
		Blooms	Course
S.No	Questions	Taxonomy	Outcome
		Level	Gatcome
1	What is linear code?	Understand	7
2	Discuss code rate?	Remember	7
3	Define code efficiency.	Remember	7
4	Explain hamming distance?	Remember	7

5	What is meant by systematic & non-systematic code?	Remember	7
6	Explain how syndrome is calculated in Hamming codes and cyclic	Understand	7
	codes?		
7	What are the conditions to satisfy the hamming code?	Understand	7
8	Define code word & block length.	Remember	7
9	What are the advantages of cyclic codes?	Remember	7
10	What is linear code?	Remember	7
11	What is constraint length of convolution code.	Understand	7
12	List advantages of convolutional codes	Understand	7
13	Discuss the difference between convolutional code and block code.	Understand	7
14	Construct the graphical representations of convolutional codes.	Understand	7
15	Construct the encoding diagram for $(3, 2, 1)$ convolutional encoder.	Remember	7
16	What is sequential decoding?	Understand	7
17	Explain about the Convolutional interleaving.	Remember	7
18	Compare coded and uncoded transmission techniques with respect to Probability of error.	Remember	7
19	What is the code length of a convolution code?	Remember	7
20	Examine the time-domain approach in convolution code.	Understand	7
21	What is the importance of code tree?	Remember	7
22	Define the term trellis in convolution code.	Remember	7
23	Explain Viterbi algorithm.	Remember	7
24	Discuss maximum-likelihood decoding rule for the binary symmetric channel.	Remember	7
PART	B (Long Answer Ouestions)		
S.No	Questions	Blooms Taxonomy Level	Course Outcome
S.No	Questions Explain syndrome decoding for cyclic code expression.	Blooms Taxonomy Level Understand	Course Outcome 7
S.No	Questions Explain syndrome decoding for cyclic code expression. What is parity check matrix and how it is used?	Blooms Taxonomy Level Understand Remember	Course Outcome 7 7
S.No 1 2 3	Questions Explain syndrome decoding for cyclic code expression. What is parity check matrix and how it is used? Explain systematic cyclic code generation formula	Blooms Taxonomy Level Understand Remember Remember	Course Outcome 7 7 7 7
S.No 1 2 3 4	Questions Explain syndrome decoding for cyclic code expression. What is parity check matrix and how it is used? Explain systematic cyclic code generation formula What are minimum distance considerations?	Blooms Taxonomy Level Understand Remember Remember Remember	Course Outcome 7 7 7 7 7 7
S.No 1 2 3 4 5	QuestionsExplain syndrome decoding for cyclic code expression.What is parity check matrix and how it is used?Explain systematic cyclic code generation formulaWhat are minimum distance considerations?Show that the syndrome depends only on the error pattern, and not on the transmitted code word.	Blooms Taxonomy Level Understand Remember Remember Remember Understand	Course Outcome 7 7 7 7 7 7 7 7
S.No 1 2 3 4 5 6	QuestionsExplain syndrome decoding for cyclic code expression.What is parity check matrix and how it is used?Explain systematic cyclic code generation formulaWhat are minimum distance considerations?Show that the syndrome depends only on the error pattern, and not on the transmitted code word.Show that the minimum distance of a linear block code is equal to the minimum number of rows of HT that sum to zero.	Blooms Taxonomy Level Understand Remember Remember Understand Understand	Course Outcome 7 7 7 7 7 7 7 7 7
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S.No 1 2 3 4 5 6 7 8	QuestionsExplain syndrome decoding for cyclic code expression.What is parity check matrix and how it is used?Explain systematic cyclic code generation formulaWhat are minimum distance considerations?Show that the syndrome depends only on the error pattern, and not on the transmitted code word.Show that the minimum distance of a linear block code is equal to the minimum number of rows of HT that sum to zero.Analyze and prove the fundamental properties of cyclic code.Show that if ci and cj are two code vectors in an (n,k) linear block code, then their sum is also a code vector.	Blooms Taxonomy Level Understand Remember Remember Understand Understand Understand	Course Outcome 7 7 7 7 7 7 7 7 7 7 7 7
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S.No 1 2 3 4 5 6 7 8 9 10	QuestionsExplain syndrome decoding for cyclic code expression.What is parity check matrix and how it is used?Explain systematic cyclic code generation formulaWhat are minimum distance considerations?Show that the syndrome depends only on the error pattern, and not on the transmitted code word.Show that the minimum distance of a linear block code is equal to the minimum number of rows of HT that sum to zero.Analyze and prove the fundamental properties of cyclic code.Show that if ci and cj are two code vectors in an (n,k) linear block code, then their sum is also a code vector.The generator polynomial of (15,11) cyclic code is g(x)= 1+x+x4. Determine the parity polynomial h(x) of this code.Compare the linear block codes, cyclic codes and the convolutional codes?	Blooms Taxonomy Level Understand Remember Remember Understand Understand Understand Remember Remember	Course Outcome 7
S.No 1 2 3 4 5 6 7 8 9 10 11	QuestionsExplain syndrome decoding for cyclic code expression.What is parity check matrix and how it is used?Explain systematic cyclic code generation formulaWhat are minimum distance considerations?Show that the syndrome depends only on the error pattern, and not on the transmitted code word.Show that the minimum distance of a linear block code is equal to the minimum number of rows of HT that sum to zero.Analyze and prove the fundamental properties of cyclic code.Show that if ci and cj are two code vectors in an (n,k) linear block code, then their sum is also a code vector.The generator polynomial of (15,11) cyclic code is $g(x)= 1+x+x4$. Determine the parity polynomial h(x) of this code.Compare the linear block codes, cyclic codes and the convolutional codes?Draw an (n-k) syndrome calculation circuit for an (n, k)cyclic code?	Blooms Taxonomy Level Understand Remember Remember Understand Understand Understand Remember Understand Remember	Course Outcome 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7
S.No 1 2 3 4 5 6 7 8 9 10 11 12	QuestionsExplain syndrome decoding for cyclic code expression.What is parity check matrix and how it is used?Explain systematic cyclic code generation formulaWhat are minimum distance considerations?Show that the syndrome depends only on the error pattern, and not on the transmitted code word.Show that the syndrome depends only on the error pattern, and not on the transmitted code word.Show that the minimum distance of a linear block code is equal to the minimum number of rows of HT that sum to zero.Analyze and prove the fundamental properties of cyclic code.Show that if ci and cj are two code vectors in an (n,k) linear block code, then their sum is also a code vector.The generator polynomial of (15,11) cyclic code is $g(x)= 1+x+x4$. Determine the parity polynomial $h(x)$ of this code.Compare the linear block codes, cyclic codes and the convolutional codes?Draw an (n-k) syndrome calculation circuit for an (n, k)cyclic code?What is meant by random errors and burst errors? Explain about a coding technique which can be used to correct both the burst and random errors simultaneously.	Blooms Taxonomy Level Understand Remember Remember Understand Understand Understand Remember Understand Remember Remember	Course Outcome 7
S.No 1 2 3 4 5 6 7 8 9 10 11 12 13	QuestionsExplain syndrome decoding for cyclic code expression.What is parity check matrix and how it is used?Explain systematic cyclic code generation formulaWhat are minimum distance considerations?Show that the syndrome depends only on the error pattern, and not on the transmitted code word.Show that the minimum distance of a linear block code is equal to the minimum number of rows of HT that sum to zero.Analyze and prove the fundamental properties of cyclic code.Show that if ci and cj are two code vectors in an (n,k) linear block code, then their sum is also a code vector.The generator polynomial of (15,11) cyclic code is g(x)= 1+x+x4. Determine the parity polynomial h(x) of this code.Compare the linear block codes, cyclic codes and the convolutional codes?Draw an (n-k) syndrome calculation circuit for an (n, k)cyclic code?What is meant by random errors and burst errors? Explain about a coding technique which can be used to correct both the burst and random errors simultaneously.Discuss about the various decoders for convolutional codes.	Blooms Taxonomy Level Understand Remember Remember Understand Understand Understand Remember Understand Remember Remember Remember	Course Outcome 7

15	Explain the systematic code form for the binary cyclic codes?	Remember	7
16	Explain about block codes in which each block of k message bits encoded into block of $n>k$ bits with an example.	Remember	7
17	Demonstrate the Viterbi algorithm for maximum-likelihood decoding of convolutional codes.	Remember	7
18	What is a convolutional code?Howis it different from a block code?	Remember	7
19	Compare the Error Rates in Coded and Uncoded Transmission	Understand	7
PART	C(ANALYTICAL QUESTIONS)		
1	For a (6, 3) systematic linear block code, the three parity check bits c4,	Remember	7
	c5, c6 are formed from the following equations.		
	C4=d1+d3		
	C5=d1+d2+d3		
	$C_0=d1+d2$		
	a) Construct all possible code words		
2	Consider the (8.4) linear block code with G	Remember	7
2	10001111	Remember	/
	01001111		
	00100011		
	0 0 0 1 0 1 0 1		
	(a) Construct all the possible code words		
	(b) Construct all the single error patterns.		
3	For a cyclic code the generator polynomial $g(x) = (x3+x2+1)$.	Remember	7
	a) If the received code is 1000110, determine the transmitted data.		
	b) If the received code is 1101101, determine the transmitted data.		
4	Consider a (7,4) cyclic code with generator polynomial $g(x) =$	Understand	7
	(x_3+x_2+1) . Determine the code for data bits 1010,1111, and 0001	TT 1 / 1	
5	Show that the syndrome S is the sum of those rows of matrix H1	Understand	/
6	Corresponding to the error locations in the error pattern.	Understand	7
0	10101111	Understand	/
	01001101		
	00010101		
	a) Construct all the possible code words		
	b) Construct all the single error patterns.		
7	The polynomial $x^{15}+1$ when factored gives	Understand	7
	$x^{15}+1=(x4+x3+1)(x4+x3+x2+x+1)(x4+x+1)(x2+x+1)(x+1)$		
	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?		
<u> </u>	The generator polynomial of a $(7, 4)$ cyclic code is $g(x) = 1 + x + x^3$ Find	Domomhor	7
0	the 16 code words of this code:	Kememuti	/
	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?		
9	For a (6,3) systematic linear block code the three parity check bits c4,	Understand	7
	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		
1	I by funding the location of the error and the transmitted data bit		

10	Construct all the negsible systematic and words for (15.5) evalue and	Domomhor	7
10	Construct an the possible systematic code words for $(15,5)$ cyclic code	Kennember	/
	with the following generator polynomial $g(x)=x^{10}+x^{0}+x^{4}+x^{2}+x+1$.		
	Construct the encoder circuit for this.		
11	Find the code word for data word 1110 in a (7,4) cyclic code using the	Remember	7
	generator polynomial $g(x)=1+x2+x3$ using encoder.	Kemember	
12	The generator matrix for $(7,4)$ block code is given below	Remember	7
	Find the parity check matrix H of this code.		
	Show that these two matricessatisfy the condition $CH^{T}=0$.		
	G =1 0 0 0 1 1 0		
	0100011		
	0010111		
	0 0 0 1 1 0 1		
13	Find the generator matrix G(D) for the (2, 1, 2) convolutional encoder of	Understand	7
	figure shown		
	$ \begin{array}{c c} \text{input} \\ \text{sequence } m \\ \text{i} \\ m_i \\ m_{i-1} \\ m_{i-2} \\ \end{array} $		
	modulo-2		
	adder-1		
	$\vee^{(1)}(x)$		
	└────────────────────────────────────		
	→		
14	Consider the $(3,1,2)$ nonsystematic convolution encoder with $g^{(0)} = (1, 1, 1)$	Remember	1
	0) $g^{(1)}=(1 \ 0 \ 1) g^{(2)}=(1 \ 1 \ 1)$ Draw the encoder block diagram		
15	A convolution encoder has 3 shift registers with two stages two	Remember	7
	modulo-2 adders and an output multiplexer. The generator sequences of		
	(1) (1) (1) (2) (1 + 0) D = (1)		
	the encoder are as follows. $g^{(-)} = (1, 1, 1, 1); g^{(-)} = (1, 1, 0, 1)$. Draw the		
16	block diagram of the encoder.	D 1	
16	Consider the $(3,1,2)$ nonsystematic convolution encoder with $g^{(0)} = (1, 1, 1)$	Remember	1
	0) $g^{(1)} = (1 \ 0 \ 1) g^{(2)} = (1 \ 1 \ 1)$ What the generator matrix for this code		
17	(0), g = (1, 0, 1), g = (1, 1, 1). What the generator matrix for this code.	Remember	7
17	Consider the $(3,1,2)$ nonsystematic convolution encoder with $g^{(0)} = (1, 1, 1)$	Remember	,
	0), $g^{(1)} = (1,0,1), g^{(2)} = (0, 1,1)$. Find the constraint length and the rate		
	efficiency of the code.		
18	A convolution encoder has 3 shift registers with two stages, two	Understand	7
	modulo-2 adders and an output multiplexer. The generator sequences of		
	the encoder are as follows.		
	$\sigma^{(1)}=(1,1,1,1)$; $\sigma^{(2)}=(1,1,0,1)$ Find the constraint length and the rate		
	g = -(1, 1, 1, 1), g = -(1, 1, 0, 1). This the constraint length and the rate		
10	Define constraint length and rate efficiency of convolution code	Understand	7
20	Examine the differences between linear block codes and convolution	Remember	7
20	codes	Kennennuer	/
21	Define metric and survivors in Viterbi algorithm with one example	Remember	7
<u></u>	UNIT.V	Kemenioer	, ,
	SPREAD SPECTRUM MODULATION		
PARTA	(Short Answer Ouestions)		
		Blooms	
S.No	Questions	Taxonomy	Course
5.110	Zuotono	Level	Outcome
1	Explains pseudo noise sequence?	Remember	8
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2	Discuss direct sequence spread spectrum modulation	Remember	8
3	What is frequency hap spread spectrum modulation?	Understand	8
4	What is processing gain?	Remember	8
5	State four applications of spread spectrum.	Understand	8
6	When is the PN sequence called as maximal length sequence?	Remember	8
7	What is meant by processing gain of DS spread spectrum system?	Remember	8
8	Discuss the applications of spread spectrum modulation?	Remember	8
9	Define frequency hopping.	Understand	8
10	Where Advantages of DS-SS systems?	Remember	8
11	What are the Disadvantages of DS-SS systems?	Remember	8
12	List the Advantages of FH-SS System	Remember	8
13	List the Disadvantages of FH-SS System	Remember	8
PARTB(Long Answer Questions)			
		Blooms	Course
S.No	Questions	Taxonomy Level	Outcome
S.No	Questions Explain the spread spectrum modulation .	Taxonomy Level Understand	Outcome 8
S.No 1 2	Questions Explain the spread spectrum modulation . Explain the frequency hopping spread spectrum modulation.	Taxonomy Level Understand Remember	Outcome 8 8
S.No 1 2 3	Questions Explain the spread spectrum modulation . Explain the frequency hopping spread spectrum modulation. Examine spread spectrum modulation using DSSS.	Taxonomy LevelUnderstandRememberRemember	Outcome 8 8 8 8
S.No 1 2 3 4	Questions Explain the spread spectrum modulation . Explain the frequency hopping spread spectrum modulation. Examine spread spectrum modulation using DSSS. Explain the spread spectrum demodulation.	Taxonomy LevelUnderstandRememberRememberRemember	Outcome88888
S.No 1 2 3 4 5	Questions Explain the spread spectrum modulation . Explain the frequency hopping spread spectrum modulation. Examine spread spectrum modulation using DSSS. Explain the spread spectrum demodulation. Explain the frequency hopping spread spectrum modulation. Explain the frequency hopping spread spectrum modulation.	Taxonomy LevelUnderstandRememberRememberRememberUnderstand	Outcome8888888
S.No 1 2 3 4 5 6	Questions Explain the spread spectrum modulation . Explain the frequency hopping spread spectrum modulation. Examine spread spectrum modulation using DSSS. Explain the spread spectrum demodulation. Explain the frequency hopping spread spectrum modulation. a) Explain the frequency hopping spread spectrum modulation. a) Explain how PN sequences are generated. What are maximal-length sequences? What are their properties and why are they preferred? b) With the help of a neat block diagram, explain the working of a DS spread spectrum based CDMA system.	Taxonomy LevelUnderstandRememberRememberRememberUnderstandRemember	Outcome88888888
S.No 1 2 3 4 5 6 7	QuestionsExplain the spread spectrum modulation .Explain the frequency hopping spread spectrum modulation.Examine spread spectrum modulation using DSSS.Explain the spread spectrum demodulation.Explain the frequency hopping spread spectrum modulation.a) Explain how PN sequences are generated. What are maximal-length sequences? What are their properties and why are they preferred?b) With the help of a neat block diagram, explain the working of a DS spread spectrum based CDMA system.a)What are the advantages of spread spectrum technique.	Taxonomy LevelUnderstandRememberRememberRememberUnderstandRememberUnderstandRememberRemember	Outcome 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
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