Code No: RT32043

R13

SET - 1

III B. Tech II Semester Regular/Supplementary Examinations, April -2018

DIGITAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1 a) A signal x(t) is band limited to 2 kHz while y(t) is band limited to 3 kHz. Find the Nyquist sampling rate for (i) x(2t) (ii)y(t-3) [4M]
b) Sketch the block diagram of ASK generation. [3M]
c) Construct FSK waveform for the input data “1101” [3M]
d) Verify that I(X;Y)=I(Y;X) [4M]
e) Calculate the capacity of AWGN channel with bandwidth of 1MHz and a S/N ratio of 40dB. [4M]
f) Differentiate block codes and convolution codes. [4M]

PART -B

2 a) What is slope overload distortion and granular noise in Delta Modulation? How is it removed in ADM? [10M]
b) A speech signal of maximum frequency 3.4 KHz is applied to a delta modulator whose bit rate is 20 Kbps. Determine minimum step size for the delta modulation so that there is no slope overload. [6M]

3 a) Explain the similarities between BPSK and BFSK. [8M]
b) A binary data stream 0010010011 needs to be transmitted using DPSK Technique. Prove that the reconstruction of the DPSK signal is independent on the choice of the extra bit. [8M]

4 a) What is a matched filter? How does it differ from an optimum filter? Derive an expression for impulse response of matched filter [10M]
b) Find the probability of error of BPSK. [6M]

5 a) What is mutual information? State and prove its properties. [10M]
b) What is joint and conditional entropy? Obtain the relationship between them [6M]

6 a) A DMS X has 4 symbols x1, x2, x3, x4 with probabilities ½, ¼, 1/8, 1/8 respectively. Construct Shannon-Fano code for X and calculate the code efficiency. [8M]
b) Show that the channel capacity of an ideal AWGN channel with infinite BW is given by $C_{\infty} \approx 1.44\frac{S}{\eta}\, b/s$.
Where S is the average signal power and $\eta/2$ is the power spectral density of WGN [8M]

7 a) What are cyclic codes? List their advantages and disadvantages. [6M]
b) Explain the Viterbi algorithm with example. [10M]

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SET - 2

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DIGITAL COMMUNICATIONS

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2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	Find the Nyquist sampling rate for the following signals (i) 5 cos(1000πt) cos(4000πt) (ii) sinc(100πt)	[4M]
	b)	Why PSK is always preferable over ASK in coherent detection?	[3M]
	c)	Define the probability of error.	[3M]
	d)	Calculate the average information content in the English language, assuming that each of the 26 characters in the alphabet occurs with equal probability.	[4M]
	e)	Define the efficiency of a Source code.	[4M]
	f)	Mention differences between systematic and non-systematic codes.	[4M]

PART -B

2	a)	How is differential PCM advantageous over PCM? Give the block diagrams of DPCM transmitter and receiver and analyze its parameters.	[10M]
	b)	In a binary PCM system, the output signal to quantizing noise ratio is to be held to a minimum value of 40 dB. Determine the number of levels and find the corresponding signal to quantizing noise ratio.	[6M]
3	a)	Determine the bandwidth required for M-ary FSK system. Draw the geometrical representation of M-ary FSK signals and find out the distance between the signals.	[10M]
	b)	What is the principle of QPSK system? Compare binary PSK and QPSK schemes .	[6M]
4	a)	Justify the significance of matched filter and give its importance.	[6M]
	b)	A binary receiver system receives a bit rate of 1Mbps. The waveform amplitude is 5 mV and the noise power spectral density is 0.5 $\times 10^{-11}$ W/Hz. Calculate the average bit error probability if the modulation schemes are ASK, FSK and PSK.	[10M]
5	a)	What is entropy? State and prove its properties.	[8M]
	b)	What is average information? State and prove its properties	[8M]
6	a)	A DMS X has 5 equally likely symbols i) Construct a Shannon-Fano code for X, calculate the efficiency of the code ii) Repeat for Huffman code and compare the results.	[8M]
	b)	Consider a AWGN channel with 4kHz bandwidth and the noise power spectral density $\eta/2 = 10^{-12}$ W/Hz. The signal power required at the receiver is 0.1mW. Calculate the capacity of this channel.	[8M]
7	a)	Explain sequential decoding process for convolutional codes.	[8M]
	b)	Draw the state diagram, tree diagram, and trellis diagram for k=3, rate 1/3 code generated by $g1(x) = 1 + x^2$, $g2(x) = 1 + x$ and $g3(x) = 1 + x + x^2$	[8M]

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SET - 3

III B. Tech II Semester Regular/Supplementary Examinations, April -2018

DIGITAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	A signal x(t) is band limited to 2 kHz while y(t) is band limited to 3 kHz. Find the Nyquist sampling rate for (i) x(t)+y(t) (ii) x(t)y(t)	[4M]
	b)	Consider the binary square 0100101. Draw the waveforms for the following signaling formats i) bipolar RZ signaling ii) AMI(alternate mark inversion) RZ signaling format	[4M]
	c)	What is the ambiguity in the decoded output in the case of PSK systems?	[3M]
	d)	If I(x1) is the information carried by message x1 and I(x2) is the information carried by message x2, then prove that the amount of information carried compositely due to x1 and x2 is I(x1,x2) = I(x1)+I(x2)	[4M]
	e)	Find the capacity of Gaussian channel of bandwidth 4KHz with noise PSD 10^{-9} W/Hz when signal energy is 0.1 J.	[4M]
	f)	Give details for hamming distance and specify the conditions to satisfy hamming code.	[3M]

PART -B

2	a)	Discuss the elements of digital communication system and list the advantages of it.	[6M]
	b)	Consider an audio signal with spectral components limited to the frequency band of 300Hz to 3300Hz. A PCM signal is generated with a sampling rate of 8000 samples/sec. The required output-signal-to-quantizing-noise ratio is 30dB. i) What is the minimum number of uniform quantization levels needed and what is the minimum number of bits per sample needed? ii) Calculate the minimum system bandwidth required.	[10M]
3	a)	How the generation of DPSK signals shall be done?	[6M]
	b)	Explain the working principles of QPSK modulation and demodulation.	[10M]
4	a)	Explain about ASK system and derive the expression for error probability of binary ASK.	[10M]
	b)	Binary data is transmitted over a telephone line with usable bandwidth of 2400 Hz using the FSK signaling scheme. The transmit frequencies are 2025 & 2225 Hz, and the data rate is 300 bits/Sec. The average signal to noise power ratio at the output of the channel is 6dB. Calculate Probability of error for the coherent demodulation scheme.	[6M]
5	a)	Show that the entropy for a discrete memory less source is maximum when the output symbols are equally probable.	[8M]
	b)	What is mutual information? And prove that for a loss less channel H (X|Y) = 0 and also prove that H(X,Y)= H(X|Y) + H(Y).	[8M]
6	a)	A DMS X has five symbols x1, x2, x3, x4 and x5 with respective probabilities 0.2, 0.15, 0.05, 0.1 and 0.5. Construct Huffman code and calculate the code efficiency.	[8M]
	~~b)~~	~~Explain the tradeoff between bandwidth and signal to noise ratio.~~	~~[8M]~~
7	a)	What are hamming codes? Discuss the error correction and detection capability of hamming code.	[8M]
	b)	Compare linear block codes and cyclic codes with an example.	[8M]

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III B. Tech II Semester Regular/Supplementary Examinations, April -2018

DIGITAL COMMUNICATIONS

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Time: 3 hours Max. Marks: 70

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2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	Discuss the advantages of DM over PCM.	[4M]
	b)	Construct the constellation diagram for QPSK.	[4M]
	c)	Give the basic components of a filter in baseband data transmission and explain briefly.	[3M]
	d)	Show that I(X;Y) = H(Y) – H(Y|X)	[4M]
	e)	Write short notes on prefix-free code with example.	[4M]
	f)	Discuss about convolutional interleaving.	[3M]

PART -B

2	a)	Explain quantization error and derive an expression for maximum SNR in PCM system that uses Linear quantization.	[10M]
	b)	Given a sine wave of frequency *fm* and amplitude *Am* applied to a delta modulator having step size Δ. Find the condition on *Am* for which slope overload distortion will occur.	[6M]
3	a)	In which way DEPSK is advantageous over DPSK? Explain with an example.	[6M]
	b)	Explain the demodulation of FSK using coherent detection.	[10M]
4	a)	Explain how integrator is used to detect the baseband signal. Obtain an expression for S/N of integrator and dump receiver.	[10M]
	b)	Derive the probability of error for FSK.	[6M]
5	a)	Define information. Show that information contained in a symbol is inversely proportional to the probability of occurrence of that symbol.	[6M]
	b)	The source 'X' generates M message, then prove the following inequality for source entropy H(x):$0 \leq H(X) \leq \log_2 M$.	[10M]
6	a)	State Shannon's source coding theorem and explain its implications	[8M]
	b)	A DMS has symbols a,b,c with probabilities 0.65, 0.2, 0.15 respectively. i) Calculate the entropy of the source ii) Calculate the entropy of second order extension of the source	[8M]
7	a)	Give the matrix description of the linear block codes.	[8M]
	b)	What is the use of syndrome? Draw the (n-k) syndrome calculation circuit for (n,k) cyclic code and explain its operation.	[8M]

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