Code No: RT32043 **R13** SET - 1

III B. Tech II Semester Regular/Supplementary Examinations, April- 2017

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)	Explain the necessity of a compander.	[3M]
	b)	Draw and explain the power spectra and geometrical representation of BFSK.	[4M]
	c)	What are the advantages and disadvantages of digital modulation schemes?	[4M]
	d)	Write short notes on Self Information and entropy.	[3M]
	e)	Explain about Binary symmetric channel.	[4M]
	f)	What are the advantages and disadvantages of block codes and convolutional codes?	[4M]

PART –B

2	a)	Derive the expression for Signal to Quantization Noise ratio in PCM.	[8M]
	b)	A DM system is designed to operate at three times the Nyquist rate for a signal with 3 KHz bandwidth. The quantizing step size is 250 mV i) Determine the maximum amplitude of a 1 KHz input sinusoid for which the delta modulator does not show slope overload ii) Determine the post filtered output SNR for the signal of part (i)	[8M]
3	a)	Explain the generation and reception of DPSK signal with example.	[8M]
	b)	Explain with neat block diagram the generation and recover of BPSK.	[8M]
4	a)	Calculate the probability of error for BFSK and BPSK.	[8M]
	b)	Derive the expression for transfer function of the Optimum filter.	[8M]
5	a)	Explain the concept of mutual information and derive its properties.	[8M]
	b)	A code is composed of dots and dashes. Assume that the dash is 3 times as long as the dot and has one-third the probability of occurrence. (i) Calculate the information in a dot and that in a dash (ii) Calculate the average information in the dot-dash code. (iii) Assume that a dot lasts for 10 ms and that this same time interval is allowed between symbols. Calculate the average rate of information transmission.	[8M]
6	a)	Show that $H(X, Y) = H(X) + H(Y \mid X) = H(Y) + H(X \mid Y)$.	[8M]
	b)	Explain in detail about binary symmetric channel and find its channel capacity.	[8M]
7	a)	Construct encoder for the (7, 4) binary cyclic code generated by $g(x) = 1+x+x^3$. Find the code words for given messages (1, 1, 1, 0) and (1, 0, 0, 1) using encoder.	[8M]
	b)	Draw Code Tree and State diagram for rate ½ convolutional encoder with Constraint length 3 and generator sequences $g_1=(1, 1, 1)$ and $g_2= (1, 0, 1)$	[8M]

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2. Answering the question in **Part-A** is compulsory
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PART –A

1 a) Explain the quantization process in detail. [3M]
b) Briefly explain about DPSK. [4M]
c) Compare probability of error of different modulation techniques. [4M]
d) Explain the concept of amount of information and its properties. [3M]
e) Calculate the capacity of AWGN channel with a usable bandwidth of 1KHz and $S/N_0 = 10^3$. N_0 is noise power spectral density. [4M]
f) Describe the procedure to generate systematic codeword in cyclic code. [4M]

PART –B

2 a) Explain μ - law and A - law companding techniques in detail. [8M]
b) Derive the expression for Signal to Quantization noise ratio in Delta modulation. Discuss about Granular noise and slope overload error in Delta modulation. [8M]

3 a) Explain BFSK modulation in detail. Draw signal space representation and PSD of BFSK. [8M]
b) Sketch the QPSK waveform for binary data 11100100. Draw Geometrical representation of QPSK. Compare QPSK with BPSK with respect to bandwidth and Probability of errorP_e. [8M]

4 a) Explain the significance of Baseband receiver? Derive the expression for probability of error in case of Baseband receiver. [8M]
b) Derive the expression for maximum signal to noise ratio in case of optimum filter [8M]

5 a) Consider five symbols given by the probabilities 1/2, 1/4, 1/8, 1/16, 1/16. [8M]
(i) Calculate Entropy (ii) Use Huffman algorithm to develop an efficient code and calculate the average number of bits/symbol. Compare with Entropy.
b) Define Entropy and explain the properties of Entropy. [8M]

6 a) Find the Channel capacity of Binary symmetric channel. [8M]
b) Consider a telegraph source having two symbols, dot and dash. The dot duration is 0.2 s. The dash duration is 3 times that of the dot duration. The probability of the dot's occurring is twice that of the dash, and the time between symbols is 0.2 s. Calculate the information rate of the telegraph source. [8M]

7 a) Consider (6, 3) Linear block code. Find Generator matrix, Parity check matrix and error correcting capabilities of the code. [8M]
b) Using Transform domain approach of convolutional codes, find coded sequence for the given rate ½ encoder with generator sequences $g_1 = (1, 0, 1)$, $g_2 = (0, 1, 1)$ and message m = (10111 ….). [8M]

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Code No: RT32043 **R13** SET - 3

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(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)	Briefly Explain about Sampling and Quantization.	[3M]
	b)	Draw signal space diagram of BFSK and explain briefly.	[4M]
	c)	Compare baseband and passband modulation techniques.	[4M]
	d)	List the properties of Information.	[3M]
	e)	Briefly explain about Binary symmetric channel.	[4M]
	f)	Define code rate, constraint length of convolutional code.	[4M]

PART –B

2	a)	A television (TV) signal with a bandwidth of 4.2 MHz is transmitted using binary PCM. The number of representation levels is 512. Calculate the following parameters. (i) The code word length (ii) The final bit rate (ii) The transmission bandwidth, assume that k=2.	[8M]
	b)	What is Delta modulation? Discuss different types of noise effects in delta modulation with waveforms.	[8M]
3	a)	Explain the Generation and Detection of QPSK Signals with the help of Block Diagram and mathematical descriptions.	[8M]
	b)	Explain in detail about DEPSK with necessary Block diagram and compare DPSK and DEPSK.	[8M]
4	a)	Explain the concept of matched filter. Derive an expression for its impulse response.	[8M]
	b)	Obtain an expression for the probability of error for BPSK and ASK.	[8M]
5	a)	State and prove the properties of mutual information.	[8M]
	b)	Calculate the information rate of Telegraph source having two symbols dot and dash. The dot duration is 0.2 sec. The dash duration is twice as long as the dot and half as probable.	[8M]
6	a)	A discrete memory less source has an alphabet of five symbols with their probabilities are 0. 5, 0.15, 0.15, 0.15, 0.05 respectively. Compute the Huffman code for this source and efficiency of this code.	[8M]
	b)	A black and white Television picture may be viewed as consisting of approximately 300000 elements each one of which may occupy one of 10 distinct brightness levels with equal probability. Assume the rate of transmission is 30 picture frames per second and signal to noise ratio is 30 dB. Using channel capacity theorem, calculate the minimum bandwidth required to support the transmission of the resultant video signal.	[8M]
7	a)	The generator polynomial for a (15, 7) cyclic code, $g(x) = 1+x^4+x^6+x^7+x^8$. Find the code vector (in systematic form) for the message polynomial, $m(x) = x^2+x^3+x^4$. Assume that the first and last bits of the code vector suffer Transmission errors. Find the syndrome, $S(x)$.	[8M]
	b)	Draw the convolutional encoder for constraint length K=3, rate 1/3 code, with generator polynomials $g_1(x) = 1+x^2$, $g_2(x) = 1+x$ and $g_3(x) = 1+x+x^2$.	[8M]

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Code No: RT32043 **R13** SET - 4

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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) Explain briefly the concept of DPCM. [3M]
b) Draw the PSD of BPSK modulation and explain. [4M]
c) Draw the block diagram of Baseband Receiver and explain briefly. [4M]
d) List the properties of mutual information. [3M]
e) Briefly explain about Shannon theorem. [4M]
f) Prove $CH^T=0$ where C is code word and H is parity check matrix. [4M]

PART –B

2 a) Describe the process of uniform and nonuniform type quantization and derive an expression for signal to quantization noise ratio. [8M]
b) The input to a DM is m(t)=0.01t. The DM operates at a sampling frequency of 20 Hz and has a step size of 2 mV. Sketch the Delta modulator output. [8M]

3 a) The binary sequence 1100100010 is applied to DPSK transmitter. [8M]
i) Sketch the resulting waveform at the transmitter output.
ii)Applying this waveform to the DPSK receiver show that the original binary sequence is reconstructed in the receiver output.
b) Explain QPSK modulation in detail with relevant waveforms. [8M]

4 a) Discuss Self Information, Entropy and their properties. [8M]
b) Consider a discrete memoryless source with source alphabet of three symbols and their probabilities 0.7, 0.15, 0.15 respectively. [8M]
i) Calculate the entropy of the source
ii) Calculate the amount of information

5 a) Find the channel capacity of Binary symmetric channel. [8M]
b) A voice grade channel of the Telephone network has a Bandwidth of 3.4 kHz. [8M]
i) Calculate the channel capacity of the Telephone channel for a signal to noise ratio of 30dB.
ii) Calculate the minimum signal to noise ratio required to support information transmission through the Telephone channel at the rate of 4800 bits per second.

6 a) State and prove Shannon Hartley theorem. [8M]
b) Consider five symbols given by the probabilities 1/2, 1/4, 1/8, 1/16, 1/16. [8M]
Use Shannon-Fano algorithm to develop an efficient code and for that code, Calculate the average number of bits/symbol. Compare with H.

7 a) Explain encoding procedure of Linear Block codes. [8M]
b) The generator polynomial for a (15, 7) cyclic code is $g(x) = 1+x^4+x^6+x^7+x^8$. Find the code vector (in systematic form) for the message polynomial $m(x) = x^2+x^3+x^4$. Assume that the first and last bits of the code vector C(x) for $m(x) = x^2+x^3+x^4$ suffer Transmission errors. Find the syndrome of S(x). [8M]

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