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

III B.Tech II Semester Regular Examinations, April - 2016
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)	Discuss about the different noise effects in Delta Modulation.	[4M]
	b)	Explain the non-coherent detection of binary FSK signals.	[4M]
	c)	What is the ambiguity in the decoded output in the case of PSK systems? Explain.	[4M]
	d)	Calculate the amount of information if binary digits occur with equal likelihood in binary PCM systems.	[4M]
	e)	What are discrete memory less channels?	[3M]
	f)	Explain about BCH codes.	[3M]

PART -B

2	a)	Explain quantization error and derive an expression for maximum SNR in PCM system that uses Linear quantization.	[10M]
	b)	In a binary PCM system, the output signal to quantizing noise ratio is to be held to a minimum value of 40dB. 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)	Sketch the QPSK waveform for the sequence 1101010010, assuming the carrier frequency equal to bit rate.	[6M]
4	a)	Draw and explain the coherent system of signal reception.	[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 and 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 Pe for the coherent and non coherent demodulation schemes.	[6M]

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5 a) Explain the mutual information and its properties. [8M]

b) A code is composed of dots and dashes. Assume that the dash is three times as long as the dot and has one-third the probability of occurrence. [8M]
(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.

6 a) Explain the tradeoff between bandwidth and signal to noise ratio. [8M]

b) 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]

7 a) Explain sequential decoding for convolutional codes. [8M]

b) Draw the state diagram, tree diagram, and trellis diagram for k=3, rate 1/3 code generated by $g_1(x) = 1+x^2$, $g_2(x) = 1+x$ and $g_3(x) = 1+x+x^2$. [8M]

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*****

PART –A

1	a)	Give the block diagram representation of DPCM.	[4M]
	b)	What are the types of digital modulation techniques? Explain briefly.	[4M]
	c)	Compare a correlator and matched filter.	[4M]
	d)	What is average information? What does it mean?	[4M]
	e)	Verify that I(X;Y)=I(Y;X).	[3M]
	f)	Compare linear block codes and cyclic codes.	[3M]

PART –B

2	a)	Explain delta modulation in detail with suitable diagram.	[10M]
	b)	Given a sine wave of frequency f_m and amplitude A_m applied to a delta modulator having step size Δ. Find the condition on A_m for which slope overload distortion will occur.	[6M]
3	a)	Explain with neat block diagram the generation and recovery of BPSK.	[8M]
	b)	What are power spectra? Explain power spectra of BPSK and BFSK signals along with graphs.	[8M]
4	a)	Explain about ASK system and derive the relation for error probability of binary ASK.	[10M]
	b)	A binary receiver system receives a bit rate of 1Mbps. The waveform amplitude is 5mV and the noise power spectral density is 0.5×10^{-11} W/Hz. Calculate the average bit error probability if the modulation schemes are ASK, FSK and PSK.	[6M]

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5 a) Explain the concept of entropy and its properties. [8M]
b) An analog signal band limited to 10kHz is quantized in 8 levels of a PCM system with probabilities of 1/4, 1/5, 1/5, 1/10, 1/10, 1/20, 1/20 and 1/20 respectively. Calculate the entropy and the rate of information. [8M]

6 a) Explain about Huffman coding. [8M]
b) A discrete memory less source has five symbols x1, x2, x3, x4 and x5 with probabilities 0.4, 0.19, 0.16, 0.15 and 0.15 respectively attached to every symbol. Construct a Shannon – Fano code for the source and calculate code efficiency. [8M]

7 a) Briefly describe about the Code tree, Trellis and State Diagram for a Convolution Encoder. [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 $D(x) = x^2+x^3+x^4$. Assume that the first and last bits of the code vector V(x) for $D(x) = x^2+x^3+x^4$ suffer transmission errors. Find the syndrome of V(x). [8M]

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*****

PART –A

1	a)	Discuss about the different noise effects in Pulse Code Modulation.	[4M]
	b)	Explain how carrier synchronization is done in QPSK.	[4M]
	c)	Explain the condition of orthogonality of two BFSK systems.	[4M]
	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)	Explain about binary symmetric channel.	[3M]
	f)	What is the use of syndromes?	[3M]

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 3.4KHz is applied to a delta modulator whose bit rate is 20Kbps. Determine minimum step size for the delta modulation so that there is no slope overload.	[6M]
3	a)	Explain the generation of M-ary ASK with a neat block diagram.	[10M]
	b)	Explain the principle of QPSK system. Compare binary PSK and QPSK schemes.	[6M]
4	a)	Explain about coherent binary PSK transmitter and receiver. Assuming channel noise to be additive white Gaussian obtain expression for probability of error.	[10M]
	b)	Calculate the transfer function of the Optimum filter.	[6M]
5	a)	Explain the concept of amount of information and its properties.	[8M]

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b) A discrete source emits one of five symbols once every millisecond. The symbol probabilities are 1/2, 1/4, 1/8, 1/16 and 1/16 respectively. Find the source entropy and information rate. [8M]

6 a) Discuss in brief about continuous channel capacity. [8M]

b) Calculate the capacity of the discrete channel shown in Fig.1. Assume r_s=1 symbol/sec [8M]

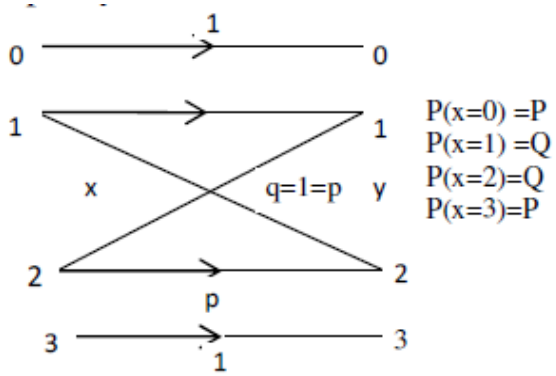

Fig -1

7 a) Explain the viterbi algorithm for the decoding of convolutional codes. [8M]

b) The parity check bits of a (8,4) block code are generated by [8M]
c5= d1+d2+d4
c6=d1+d2+d3
c7=d1+d3+d4
c8=d2+d3+d4
where d1, d2, d3 and d4 are the message digits.
(i) Find the generator matrix and parity check matrix for this code
(ii)Find the minimum weight of this code
(iii)Find the error detecting capabilities of this code.

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*****

PART –A

1	a)	Explain the importance of prediction in DPCM.	[4M]
	b)	What are the drawbacks of BPSK? How can they be overcome?	[4M]
	c)	What type of synchronization is used in QPSK system? Explain.	[4M]
	d)	What is entropy? What does it mean?	[4M]
	e)	For a noiseless channel with 'm' input symbols and 'm' output symbols, prove that H(X)=H(Y).	[3M]
	f)	What is constraint length for convolutional encoders? Explain.	[3M]

PART -B

2	a)	What is the necessity of non-uniform quantization and explain companding.	[10M]
	b)	If m_p = 20V and 256 quantizing levels are employed, what is the voltage between levels when there is no compression? For μ = 255, what is the smallest and what is the largest effective separation between levels?	[6M]
3	a)	Draw the block diagram of DPSK modulator and explain how synchronization problem is avoided for its detection.	[10M]
	b)	Write the power spectral density of BPSK and QPSK signals and draw the power spectrum of each.	[6M]
4	a)	What is matched filter? How it differs from optimum filter? Derive an expression for impulse response of matched filter	[10M]
	b)	In a binary PCM system on/off signaling is used. The matched filter receiver is used for detection of signal. Calculate the probability of error if signaling rate is doubled.	[6M]

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5	a)	Explain the concept of amount of information.	[8M]
	b)	An analog signal is band limited to B Hz, sampled at the nyquist rate, and the samples are quantized into 4 levels. The quantization levels Q1, Q2, Q3 and Q4 (messages) are assumed independent and occur with probabilities p1= p4=1/8 and p2= p3=3/8. Find the information rate of the source.	[8M]
6	a)	Consider five messages given by the probabilities 1/2, 1/4, 1/8, 1/16, 1/16. (i) Calculate H (ii) Use Shannon-Fano algorithm to develop an efficient code and for that code, calculate the average number of bits/message. Compare with H.	[10M]
	b)	Explain the tradeoff between bandwidth and signal to noise ratio.	[6M]
7	a)	Explain matrix description of linear block codes.	[8M]
	b)	Design an encoder for the (7,4) binary cyclic code generated by $g(x) = 1 + x + x^3$ and verify its operation using the message vector (0 1 0 1).	[8M]
