Code No: R1631044 **R16** SET - 1

III B. Tech I Semester Regular Examinations, October/November - 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. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) What is uniform quantization? [2M]
   b) Draw the block diagram of BPSK demodulator. [2M]
   c) Give the expression for the BER of polar signaling. [2M]
   d) Define source entropy. [3M]
   e) What is the relation between channel capacity, channel bandwidth and S/N? [3M]
   f) Define the code rate of convolutional encoder. [2M]

PART -B

2. a) Derive an expression for mean-square value of quantization error. [7M]
   b) What is aliasing? What causes it? How can it be reduced? [7M]

3. a) Explain the process of generating FSK signals. [7M]
   b) Describe the process of detecting DPSK signals. [7M]

4. Derive an expression for BER of BPSK scheme. [14M]

5. a) A memory less source emits messages m_1 and m_2 with probabilities 0.8 and 0.2, respectively. Find the Huffman binary code for this source. Determine the code efficiency. [7M]
   b) A message source generates one of four messages randomly every microsecond. The probabilities of these messages are 0.4, 0.3, 0.2, and 0.1. Each emitted message is independent of the other messages in the sequence. Find the source entropy. [7M]

6. a) Given a generator matrix $G = [1\ \ 1\ \ 1]$. Construct a (3, 1) code. How many errors can this code correct? [7M]
   b) Determine the Hamming bound for a ternary code (whose three code symbols are 0, 1, 2). [7M]

7. a) What is a binary symmetric channel? Write down its transition matrix in terms of p, the transition probability. [7M]
   b) Write notes on syndrome decoding. [7M]

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Code No: R1631044 **R16** SET - 2

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PART –A

1. a) What is the difference between uniform and non-uniform quantization? [2M]
   b) Draw the ASK waveform for the data 1 1 0 1 0 1 1 0 1 using unipolar signaling. [2M]
   c) Give the expression for BER of coherent BPSK scheme. [2M]
   d) Define information rate. [3M]
   e) Define channel capacity. [3M]
   f) What are the different representations of convolutional encoder? [2M]

PART -B

2. a) Draw the PCM system block diagram and explain its operation. [7M]
   b) A DM system can handle message signals of bandwidth up to 5 kHz and has a sampling rate of 50 kHz. A sinusoidal signal of 1.5 volts peak amplitude and frequency 2 kHz is applied to the system. Determine [7M]
   i) the step-size Δ required to avoid slope overload
   ii) the $(S/N)_q$ for the system for the given sinusoidal signal.

3. a) Explain the process of detection of BPSK signals. [7M]
   b) Is it possible to detect BFSK signals non-coherently? If yes, explain. [7M]

4. Explain why the matched filter is called as an optimum filter. Why the name matched filter? [14M]

5. A memory less source emits six messages with probabilities 0.3, 0.25, 0.15, 0.12, 0.1 and 0.08. Find the Huffman code. Determine its average word length, the efficiency and the redundancy. [14M]

6. a) If G and H are the generator and parity check matrices, respectively, then show that $GH^T = 0$. [7M]
   b) A generator matrix $G = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$ generates a (4,2) code. What is the parity check matrix of this code? [7M]

7. What are the different methods of decoding of convolutional codes? Explain. [14M]

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Code No: R1631044 **R16** SET - 3

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	What is the difference between PCM and DPCM?	[2M]
	b)	Draw the block diagram of BFSK detector.	[2M]
	c)	Give the expression for optimum demodulation of DPSK signals.	[2M]
	d)	Define mutual information.	[3M]
	e)	Give the transition matrix of binary symmetric channel.	[3M]
	f)	Draw the state diagram of a convolutional encoder with $k = 1$, $n = 2$ and $r = 1/2$.	[2M]

PART -B

2.	a)	Explain the operation of delta modulator and demodulator.	[7M]
	b)	With the help of block schematic diagrams of the transmitter and the receiver, explain the working of binary PCM system.	[7M]
3.	a)	For a fixed bit-error probability, comment on the bandwidth efficiencies and the average transmitted power requirements of BPSK and QPSK schemes.	[7M]
	b)	Draw the power spectrum of BPSK and BFSK signals.	[7M]
4.	a)	Explain the properties of the matched filter.	[7M]
	b)	What is the need for synchronization in digital communication system?	[7M]
5.	a)	Define the following terms: i) optimal code ii) instantaneous code iii) average length of a code	[7M]
	b)	A message source generates one of four messages randomly every microsecond. The probabilities of these messages are 0.4, 0.3, 0.2, and 0.1. Each emitted message is independent of the other messages in the sequence. Find the rate of information generated by this source (in bits per second).	[7M]
6.	a)	Find a generator polynomial $g(x)$ for a (7, 4) cyclic code. Determine the code vectors for the data vector: **1010**	[7M]
	b)	Write notes on syndrome decoding.	[7M]
7.		Explain the trellis diagram decoding using Viterbi decoding algorithm.	[14M]

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Code No: R1631044 **R16** SET - 4

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	What is the need for adaptive delta modulation?	[2M]
	b)	Draw the DPSK signal generator block diagram.	[2M]
	c)	Give the expression for BER of QPSK receiver.	[2M]
	d)	A source generates two symbols with probability 0.5 and 0.5. Find the source entropy.	[3M]
	e)	What is binary symmetric channel?	[3M]
	f)	What is the difference between hard-decision decoding and soft-decision decoding?	[2M]

PART -B

2.	a)	Compare PCM and DM systems.	[7M]
	b)	What are the different types of noise in DM system? Explain.	[7M]
3.	a)	Explain the method of detecting BPSK signals.	[7M]
	b)	What are the similarities between BPSK and BFSK signals?	[7M]
4.		Derive a general expression for probability of error.	[14M]
5.	a)	Define mutual information and list its properties.	[7M]
	b)	Define the following: i) Shannon's Source Coding Theorem ii) Channel Capacity	[7M]
6.	a)	Find a generator polynomial $g(x)$ for a (7,4) cyclic code, and find code vectors for the data: **0001**	[7M]
	b)	Construct a systematic (7,4) cyclic code using the generator polynomial $g(x) = x^3 + x^2 + 1$	[7M]
7.		A convolutional encoder is shown in Figure.1.Draw the state diagram of it.	[14M]

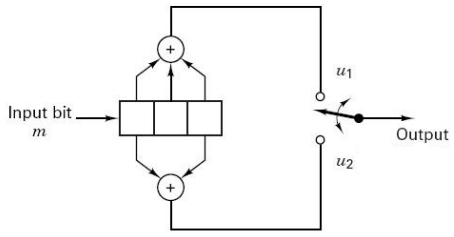

Figure.1

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