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

III B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019

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 (14 Marks)

1. a) What is the bandwidth requirement of a PCM system? [2M]
   b) What are the advantages of M-ary Signalling Schemes? [2M]
   c) Distinguish between coherent and non-coherent reception. [2M]
   d) Explain the significance of H(X/Y) of a communication system where, X is the transmitter and Y is the Receiver. [3M]
   e) What is the difference between Channel coding and Source coding? [3M]
   f) Explain the error correction capability of Hamming codes. [2M]

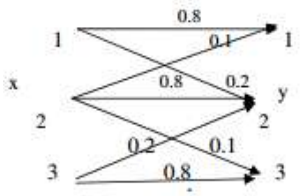
PART –B (56 Marks)

2. a) What are the two major sources of noise in a PCM system? Derive the expression for the output signal to quantization noise ratio in PCM. [7M]
   b) A voice frequency signal band limited to 3 MHz is transmitted with the use of the DM system. The pulse repetition frequency is 30,000 pulses per second, and the step size is 40 mV. Determine the maximum possible speech signal amplitude to avoid a slope overload. [7M]

3. a) With a neat sketch, explain the modulation and detection of 8-PSK. [7M]
   b) Compare binary signalling schemes and M-ary Signalling Schemes. [7M]

4. a) Find the probability of error using matched filter. [7M]
   b) Derive the error probability of BFSK modulation system. [7M]

5. a) What are the properties of Entropy and with suitable example, explain the entropy of binary memory less source. [7M]
   b) Find the capacity of the discrete channel shown in following figure: [7M]



r_s=10,000 bits/sec.
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6. a) Explain the trade-off between bandwidth and signal to noise ratio. [7M]

   b) A source is transmitting six messages with probability 0.30, 0.25, 0.15, 0.12, 0.10 and 0.08 respectively. [7M]
   i) Find the binary Huffman code.
   ii) Determine its average word length, efficiency and redundancy.

7. a) Prove that a linear block code with a minimum distance d_{min} can correct up to $(d_{min} -1)/2$ errors in each code word, where $(d_{min} -1)/2$ denote the largest integer number greater than $(d_{min} -1)/2$. [7M]

   b) Consider (7, 4) linear code whose generator matrix is [7M]

$$G = \left[\begin{array}{cccc:ccc} 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{array}\right]$$

   i) Find the minimum weight of this code.
   ii) Prove equation $CH^T=0$.

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

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DIGITAL COMMUNICATIONS

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Time: 3 hours Max. Marks: 70

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

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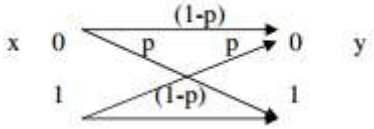
PART –A (14 Marks)

1.	a)	What are the different Line coding techniques?	[2M]
	b)	Give the Signal Space representation of QPSK.	[2M]
	c)	What is the significance of Matched Filter?	[2M]
	d)	Calculate the entropy of the source with a symbol set containing 64 symbols each with a probability Pi= 1/64.	[3M]
	e)	What is the trade-off between bandwidth and S/N?	[3M]
	f)	What is the significance of Trellis Diagram?	[2M]

PART –B (56 Marks)

2.	a)	With a neat sketch explain the principle and operation of Delta Modulation.	[7M]
	b)	Explain the differences between TDM and FDM systems.	[7M]
3.	a)	With a neat sketch, explain the modulation and detection of Differential Phase shift Keying.	[7M]
	b)	Compare QPSK, 16-PSK, QASK and 16-QASK modulation systems.	[7M]
4.	a)	With a neat sketch explain the Base band signal receiver?	[7M]
	b)	Derive the expression for signal to RMS noise ratio for the Base band signal receiver.	[7M]
5.	a)	Define Information rate. A Binary symmetric channel shown in the following figure. Find the rate of information transmission over this channel when p=0.8. Assume that the symbol (or bit) rate is 1000 bits/sec.?	[7M]



b) Prove: H(X,Y) = H(X)+ H(Y / X) = H(Y) + H(X / Y). [7M]
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6. a) A discrete memory less source has an alphabet of seven symbols with probability for its output as described here: [7M]

Symbol	prob.
S_0	0.25
S_1	0.25
S_2	0.125
S_3	0.125
S_4	0.125
S_5	0.0625
S_6	0.0625

i) Compute the Huffman code for this source and explain why the computed source code has an efficiency of 100 percent?
ii) Calculate H.

b) Find the capacity of a Gaussian channel. [7M]

7. a) Consider a (7,4) linear block code with the parity-check matrix H given by: [7M]

$$H = \begin{bmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

Construct code words for this (7, 4) code and show that this code is a Hamming code.

b) With an example, explain the decoding using Viterbi algorithm. [7M]

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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 (14 Marks)

1. a) Give the classifications of Digital communication systems. [2M]
   b) What are the drawbacks of DPSK? [2M]
   c) What is an Optimum Filter? [2M]
   d) What is memory less source? Give one example. [3M]
   e) Give the expression for channel capacity of a Gaussian Channel. [3M]
   f) Distinguish between Linear Codes and Convolutional codes. [2M]

PART –B (56 Marks)

2. a) With a neat sketch explain the principle and operation of PCM. [6M]
   b) The information in an analog signal voltage waveform is to be transmitted over a PCM system in an accuracy of ±0.1% (full scale). The analog voltage waveform has a bandwidth of 100 Hz and an amplitude range of -10 V to +10 V. [8M]
   i) Find the minimum sampling rate required.
   ii) Find the number of bits in each PCM word.
   iii) Minimum bit rate required in the PCM signal.
   iv) Find the minimum absolute channel bandwidth required for the transmission of the PCM signal.

3. a) With a neat sketch, explain the modulation and detection of M-ary QASK. [7M]
   b) Compare 16-ary PSK, 16-ary FSK, and 16-ary QASK in context to error probability and transmission BW. [7M]

4. a) With a neat sketch, explain the non-coherent detection of FSK. [7M]
   b) Find the Probability of error of Integrate and Dump circuit. [7M]

5. a) Explain the following: i) Average Information, ii) Mutual Information. [7M]
   b) Find the relation between the mutual information and the joint entropy of the channel input and channel output. [7M]
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6. a) A discrete memory less source has an alphabet of seven symbols with probability for its output as described here: [7M]

Symbol	prob.
S_0	0.25
S_1	0.25
S_2	0.125
S_3	0.125
S_4	0.125
S_5	0.0625
S_6	0.0625

i) Use the Shanon-fano algorithm to develop an efficient code, and
ii) For that code, calculate the average number of bits/message.

b) Write short note on Shannon's theorem and its bound. [7M]

7. a) What is a block-code? Analytically compare the error performance of a block coded system with other codes. [7M]

b) Explain encoding of convolution codes using time domain approach. [7M]

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III B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019

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 (14 Marks)

1. a) What are the drawbacks of DM system? [2M]
   b) Define Mark and Space frequencies. [2M]
   c) What is integrator and Dump circuit? [2M]
   d) State the channel coding theorem for a discrete memory less channel. [3M]
   e) State Shannon Hartley theorem. [3M]
   f) Define Linear Codes and Systematic Linear codes. [2M]

PART –B (56 Marks)

2. a) With a neat sketch, explain the principle and operation of ADM. [7M]
   b) What is the significance of Companding? Explain μ law companding in detail. [7M]

3. a) With neat sketch, explain the modulation and detection of M-ary FSK. [7M]
   b) What are the draw backs of DPSK and how can they overcome by DEPSK? [7M]

4. a) Find the Probability of error of Optimum Filter. [7M]
   b) Calculate the error probability of BPSK. [7M]

5. a) With examples, explain the concept of amount of information. [7M]
   b) An analog signal band limited to 10 KHz quantize at 8 levels of PCM System with probability of 1/4, 1/5, 1/5, 1/5, 1/10, 1/20,1/20, and 1/20 respectively. Find the entropy and rate of information. [7M]

6. a) An analog signal having 4 kHz bandwidth is sampled at 1.25 times the Nyquist rate and each sample is quantized into one of 256 equally likely levels. Assume that the successive samples are statistically independent: [7M]
   i) Can the output of this source be transmitted without error over an AWGN channel with a bandwidth of 10k Hz and S/N ratio of 20dB?
   ii) Find the S/N ratio required for error free transmission for part (i)
   iii) Find the bandwidth required for an AWGN channel for error free transmission of the output of this source if the S/N ratio is 20dB.
   b) Define mutual information and equivocation in transmission of information. Describe Shannon-Hartley law. [7M]

7. a) Consider (7, 4) linear code whose generator matrix is [7M]

$$G = \left[\begin{array}{cccc:ccc} 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{array}\right]$$

   i) Find all code vectors of this code, ii) Find the parity check matrix for this code.
   b) Write short notes on BCH Codes. [7M]

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