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

III B. Tech I Semester Regular/Supplementary Examinations, March - 2021

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) State any two differences between natural Sampling and Flat-top Sampling. [2M]
   b) Draw the PSD of ASK signal. [2M]
   c) What do you mean by optimum filter? [2M]
   d) List the properties of mutual information. [3M]
   e) List the advantages of source coding. [3M]
   f) What is the use of Viterbi algorithm. [2M]

PART –B (56 Marks)

2. a) What is the disadvantage of uniform quantization over the non-uniform quantization? [5M]
   b) Consider a DM system designed to accommodate analog message signals limited to a bandwidth, w=5 kHz. A sinusoidal test signal of amplitude A=1 V and frequency f_m=1 kHz is applied to the system. The sampling rate of the system is 50 kHz.
   i) Calculate the step size required to minimize slope overload.
   ii) Calculate the signal to quantization noise ratio of the system for the specified sinusoidal test signal. [6M]
   c) How are slope overload and granular noise distortions removed in ADM? [3M]

3. a) Explain the working of BPSK modulation and demodulation. [5M]
   b) Explain the similarity of BFSK and BPSK. [3M]
   c) Explain non-coherent detection methods of binary frequency shift keying scheme. [6M]

4. a) What is correlator? Explain the optimum filter reception using correlator. [7M]
   b) Derive the probability error of BFSK system and explain its operation. [7M]

5. a) An analog signal band limited to 10 kHz quantize is 8-lavels of PCM System with probability of 1/4, 1/5, 1/4, 1/10, 1/20, 1/10, 1/20 and 1/10 respectively. Find the entropy and rate of information. [7M]
   b) If X represents the outcome of a single roll of a fair die. What is the entropy of X? [7M]

6. a) Apply Shanon-Fano coding to the source with 8 emitting messages having probabilities 1/2, 3/20, 3/20, 2/25, 2/25, 1/50, 1/100 and 1/100 respectively, find the coding efficiency. [7M]
   b) Explain the Huffman coding in detail along with example. [7M]
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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.
iii) Find the minimum weight of this code.
iv) Prove equation $CH^T=0$.

b) Explain the procedure of Binary cyclic codes with one example. [7M]

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

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2. Answer **ALL** the question in **Part-A**
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PART –A (14 Marks)

1. a) Define quantization noise power. [2M]
   b) What do you mean by companding? [2M]
   c) What is Manchester coding? What are its advantages? [2M]
   d) What is Inter Symbol Interference? [3M]
   e) What is the need for source coding? [3M]
   f) What is the need for channel coding? [2M]

PART –B (56 Marks)

2. a) Discuss the uniform and non uniform quantization and compare them. [4M]
   b) Discuss the elements of digital communication system and list the advantages of it. [7M]
   c) Briefly list out the differences between PCM and DM. [3M]

3. a) Discuss the representation and characteristics of ASK, PSK, QAM, QPSK and FSK signals. [5M]
   b) Determine the bandwidth required for M-ary FSK. Draw the geometrical representation of M-ary FSK signal. [6M]
   c) Discuss the principle of DPSK. [3M]

4. a) Derive the probability error of QPSK system and explain its operation. [7M]
   b) What is a matched filter? How it differs from an optimum filter. Derive an expression for impulse response of the matched filter. [7M]

5. a) Explain the following terms in detail: [7M]
   i) Entropy, ii) Binary symmetric channel, iii)Channel Capacity, iv)Discrete messages.
   b) Define Mutual information. Prove I(X,Y) = H(X) – H(X/Y). [7M]

6. a) What is binary symmetric channel and derive expression for its capacity. [7M]
   b) Apply Shannon-Fano coding for the 5 messages with probabilities 0.4, 0.15, 0.15, 0.15, 0.15 and find the coding efficiency. [7M]

7. a) What is CRC? If the generating polynomial for CRC code is x^4+x^3+1 and message word is 11110000, determine check bits and codeword. [7M]
   b) Explain the significance of Trellis structure in detail. [7M]

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

III B. Tech I Semester Regular/Supplementary Examinations, March - 2021

DIGITAL COMMUNICATIONS

(Electronics and Communication Engineering)

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) State sampling theorem. [2M]
   b) Express some advantages and disadvantages of digital communication system. [2M]
   c) Give the expression for BER of QPSK scheme. [2M]
   d) Define channel capacity. [3M]
   e) What are the error detection and correction capabilities of hamming codes? [3M]
   f) Define constraint length of a convolutional encoder. [2M]

PART –B (56 Marks)

2. a) Describe the μ-Law and A-Law in PCM. [3M]
   b) Explain the operation of DPCM techniques. List the advantages and disadvantages of it. [7M]
   c) Discuss about the noise effects in delta modulation. [4M]

3. a) Draw and explain the signal space representation of the QPSK. List the advantages of it. [5M]
   b) Distinguish coherent and non-coherent detection. [4M]
   c) Discuss the ASK system in detail. [5M]

4. a) Derive the probability of error for BPSK. [7M]
   b) What are the characteristics of optimum filter? Explain in detail. [7M]

5. a) The source ‘X’ generates M message, then prove the following inequality for source entropy $H(x):0 \leq H(X) \leq \log_2 M$. [7M]
   b) What is mutual information? State and prove the properties of it. [7M]

6. a) One of five possible message Q1 to Q5 having probabilities 1/4, 1/2, 1/8, 1/16, 1/16 respectively are transmitted. Generate Huffman code and calculate the coding efficiency. [7M]
   b) What is Shannon theorem? Obtain the channel capacity for Gaussian channel. [7M]

7. a) What is the structural representation of Linear Block codes and give the Matrix description of Linear Block codes. [7M]
   b) State and prove the properties of syndrome decoding. [7M]

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

III B. Tech I Semester Regular/Supplementary Examinations, March - 2021

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(Electronics and Communication Engineering)

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 advantages of delta modulation? [2M]
   b) Mention the need of optimum transmitting and receiving filter in baseband data transmission. [2M]
   c) Define Duo binary baseband PAM system. [2M]
   d) Define entropy and list its advantages. [3M]
   e) Define code efficiency. [3M]
   f) What do you mean by a Binary Symmetric Channel? [2M]

PART –B (56 Marks)

2. a) Explain the techniques: Quantization and Encoding in a PCM system. [3M]
   b) 24 Telephone channels, each band limited to 3.4 kHz, are to be time division multiplexed by using PCM. Calculate the bandwidth of the PCM system for 128 quantization level and an 8 kHz sampling frequency. [5M]
   c) Draw the block diagram of DPCM systems and explain its operation. [6M]

3. a) Derive an expression for the spectrum of BPSK and draw a neat sketch. [4M]
   b) A bit stream 1011111011 is to be transmitted using ASK, FSK, and PSK techniques. Draw the waveforms for the above mentioned digital modulation techniques. [3M]
   c) Explain the working of BFSK. [7M]

4. a) Derive the bit error probability due to QPSK receiver. Compare the performance of QPSK receiver with that of PSK receiver. [7M]
   b) Explain how a matched filter can maximize SNR for a given transmitted symbol. [7M]

5. a) State and prove the properties of entropy. [7M]
   b) If $I(x_1)$ is the information carried by symbol x_1 and $I(x_2)$ id the information carried by symbol x_2 then prove that the amount of information carried compositely due to x_1 and x_2 is $I(x_1, x_2) = I(x_1)\, I(x_2)$. [7M]

6. a) Apply Huffman coding to the source with 8 emitting messages having probabilities 1/2, 3/20, 3/20, 2/25, 2/25, 1/50, 1/100 and 1/100 respectively, find the coding efficiency. [7M]
   b) State and prove the Shannon Hartley theorem. [7M]

7. a) Explain tree diagram, trellis diagram and state transition diagram of convolutional codes. [7M]
   b) Explain the decoding process using Viterbi algorithm. [7M]

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