T.E. (EXTC) (Sem-V) (CB)

Paper / Subject Code: 32202 / Digital Communication

Date-19/11/19

Time: 3 Hours **Marks: 80**

NB. 1. Question No. **1** is **compulsory**.
2. Attempt **any three** out of remaining five questions.
2. Figures to right indicate full marks.
3. Assume data wherever required and state it clearly.

Q1 20

a) When are two events said to be independent? What is the joint probability of two independent events?
b) What is an optimum receiver and what is it optimized for?
c) Prove $H_{max} = \log_2 M$.
d) Estimate Nyquist rate and Nyquist interval for the signal $10\cos(2000\pi t)\cos(4000\pi t)$ based on low pass sampling theory.
e) For impulse responses $g^1=\{1,0,0\}$, $g^2=\{0,1,0\}$, $g^3=\{1,0,1\}$ design the state diagram.

Q2

a) A discrete memoryless source has an alphabet of six symbol with their probabilities as shown:

Symbol	M_1	M_2	M_3	M_4	M_5	M_6
Probability	1/2	1/4	1/8	1/16	1/32	1/32

i) Determine the Minimum Variance Huffman code-words and average code-word length and hence find Entropy of the system,
ii) Verify the average code-word length using Shannon Fano,
iii) Compare and comment on the results of both. 10

b) A convolution encoder has a constraint length of 3 and code rate of 1/3. The impulses for each are $g^1=100$ $g^2=101$ $g^3=111$. Draw
i) encoder
ii) state diagram
iii) code transfer function

10

Q3

a) What is PDF? How do we get PDF from probability distribution function? 10
b) What is matched filter? Derive the expression for its output SNR. 10

Q4

a) For a systematic linear block, the three parity check digits, C3, C2, C1 are given by:

$$C3 = d1 \oplus d2 \oplus d3$$
$$C2 = d1 \oplus d2$$
$$C1 = d1 \oplus d3$$

i) Find Generator matrix using which find out the code-words of 110 and 010 ,
ii) Determine the error correcting and detecting capability of system,
iii) Prepare suitable decoding table and find transmitted message for received code 101100 and 000110.
10

b) Sketch the encoder and syndrome calculator for the generator polynomial $g(x)=1+x^2+x^3$ and obtain the syndrome for the received code-word 1101011. 10

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Q5

a) Discuss QPSK signalling. Derive the bit error probability due to PSK receiver. 10

b) Represent the given data sequence 110011010011 with help of neat waveforms in

i) Manchester format

ii) NRZ

iii) AMI-RZ

iv) RZ

10

Q6

Explain with the required diagrams **(Any Three):** 20

i) Compare BPSK and QPSK

ii) Modified duo-binary encoder

iii) Gram- Schmidt orthogonalization procedure

iv) Define the following terms and give their significance

(i) Systematic and Non-systematic codes (ii) Code rate

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1 message

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Q.P. Code: **71271**

Q.3 a) Read as
What is **CDF**? how do we get **CDF** from probability distribution function?
instead of
What is **PDF**? how do we get **PDF** from probability distribution function?

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