



ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER - 2007
DIGITAL COMMUNICATION SYSTEMS
SEMESTER - 5

Time : 3 Hours]

[Full Marks : 70

GROUP - A**(Multiple Choice Type Questions)**

1. Choose the correct alternatives for any ten of the following : 10 × 1 = 10

i) The spectral density of white noise is

- | | |
|----------------|--------------|
| a) exponential | b) uniform |
| c) Poisson | d) Gaussian. |

ii) Sampling theorem finds application in

- | | |
|-------------------------|-------------------------|
| a) Amplitude modulation | b) Frequency modulation |
| c) PCM | d) None of these. |

iii) Measure of information $I(m_k)$ of a message m_k with probability p_k is given by

- | | |
|----------------------|----------------------------|
| a) $\log_b(1/p_k)$ | b) $\log_b(p_k)$ |
| c) $\log_b(1 - p_k)$ | d) $\log_b[1/(1 - p_k)]$. |

iv) What is effective to reduce cumulative error ?

- | | |
|---------------------------|---------|
| a) PCM | b) DPCM |
| c) Delta Sigma Modulation | d) ADM. |

v) To avoid aliasing, what is the Nyquist rate of this signal $x(t) = 8 \cos 200\pi t$?

- | | |
|-----------|------------|
| a) 50 Hz | b) 100 Hz |
| c) 200 Hz | d) 400 Hz. |



- vi) To find spectrum of any aperiodic signal the tool is

a) Fourier Series	b) Taylor Series
c) Fourier Transform	d) Binomial Series.

vii) How many bits would be required to represent a 256 level quantization in PCM ?

a) 6	b) 8
c) 5	d) 7.

viii) For generation of FSK the data pattern must be given in

a) RZ format	b) NRZ format
c) Split-phase Manchester	d) None of these.

ix) The bit rate of digital communication system is 34 Mbits/sec. The modulation scheme is QPSK. The baud rate of the system is

a) 8.5 M bits/sec	b) 17 M bits/sec
c) 34 M bits/sec	d) 68 M bits/sec.

x) The Gaussian probability density is defined as

a) $f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-(x-m)^2/2\sigma^2}$
b) $f(x) = \frac{1}{2\pi\sigma^2} e^{-(x-m)^2/2\sigma^2}$
c) $f(x) = \frac{1}{\pi\sigma} e^{-(x-m)^2/2\sigma^2}$
d) None of these.

xi) Frequency shift keying is used mostly in

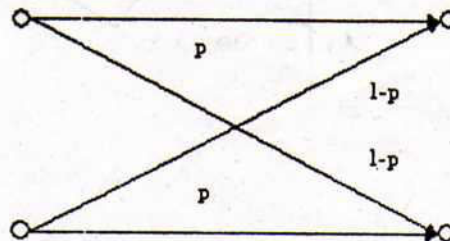
a) Radio transmission	b) Telegraphy
c) Telephony	d) None of these.

xii) Quantization noise depends on

a) step size	b) signal amplitude
c) number of bits	d) none of these.

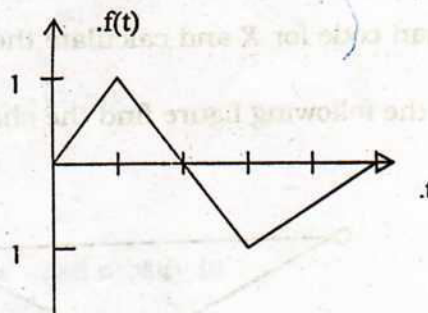
**GROUP - B****(Short Answer Type Questions)**Answer any *three* of the following. $3 \times 5 = 15$

2. What are the advantages of digital communication system over analog communication ?
3. What is companding ? Why is it needed ? $3 + 2$
4. Given the data stream 1110010100,
sketch the transmitted sequence of rectangular pulses for each of the following line codes :
 - a) Unipolar NRZ
 - b) Unipolar RZ
 - c) Polar RZ
 - d) Polar NRZ
 - e) Manchester.
5. A discrete memoryless source X has five symbols $x_i, (i = 1, \dots, 5)$ with $P(x_1) = 0.4, P(x_2) = 0.19, P(x_3) = 0.13, P(x_4) = 0.16$ and $P(x_5) = 0.12$. Construct the Huffman code for X and calculate the efficiency of the code.
6. For a BSC shown in the following figure find the channel capacity for $p = 0.6$.



**GROUP - C****(Long Answer Type Questions)**Answer any *three* of the following questions. $3 \times 15 = 45$

7. a) Draw the block diagram for generation and detection of the BFSK signal and explain clearly its operation.
- b) Draw the signal space representation and find the distance between symbols.
- c) What is the difference between MSK and QPSK ? $6 + (3 + 2) + 4$
8. a) What is Nyquist criterion for zero intersymbol interference ?
- b) What are the limitations of ideal solution and how can it be solved with the help of raised cosine function ?
- c) A communication channel of bandwidth 75 kHz is required to transmit binary data at a rate of 0.1 Mbps using raised cosine pulses. Determine the roll of factor α . $4 + 7 + 4$
9. a) What is a matched filter ?
- b) Draw the impulse response of an optimum filter matched to the following input $f(t)$.



- c) If a rectangular pulse of amplitude A and with T is applied to a matched filter, find the spectrum of the matched filter output and also the output signal in the time domain. $3 + 4 + 8$



10. a) A discrete memoryless source has an alphabet of 7-symbols with probabilities for its output :

Symbols →	S_0	S_1	S_2	S_3	S_4	S_5	S_6
Probabilities →	0.25	0.25	0.125	0.125	0.125	0.0625	0.0625

Apply Shanon-Fano algorithm to this & calculate the efficiency & variance of this coding.

- b) What is the disadvantage of Huffman coding ?
- c) Write down the algorithm for Huffman coding for moving a "combined" symbol as high as possible. Explain with suitable example. 8 + 2 + 5

11. a) One parity check code has parity check matrix as :

$$H = \left| \begin{array}{cc|cc} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{array} \right|$$

- i) Determine generator matrix
- ii) Find the code word that begins [101]
- iii) If received word is [110110], then decode this word.
- b) Write the properties of Hamming distance d_{min} . (2 + 4 + 4) + 5

END