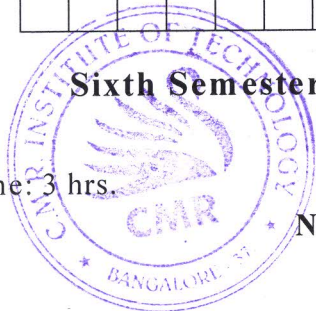


CBCS SCHEME

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15EC61



Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019

Digital Communication

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- Define Hilbert transform. What are its applications. Prove that a signal $g(t)$ and its Hilbert transform $\tilde{g}(t)$ are orthogonal over the entire time interval $(-\infty, \infty)$. (05 Marks)
 - Determine the pre-envelope and complex envelope of the RF pulse defined by $x(t) = A \text{rect}\left(\frac{t}{T}\right) \cos(2\pi f_c t)$. (06 Marks)
 - Compare the power spectra of various line codes in terms of bandwidth, DC component, Noise immunity and synchronization capability, with neat sketch. (05 Marks)

OR

- Express bandpass signal $s(t)$ in canonical form. Also explain the scheme for deriving the inphase and quadrature components of the bandpass signal $s(t)$. (06 Marks)
 - Explain with relevant expressions, the procedure for computational analysis of a bandpass system driven by a bandpass signal. (06 Marks)
 - What is the advantage of HDB3 code over conventional alternate mark inversion(AMI) code. Code the pattern "1010000011000011000000" using HDB3 encoding and AMI encoding. (04 Marks)

Module-2

- Explain the geometric representation of set of M energy signals as linear combination of N orthonormal basis functions. illustrate for the case $N = 2$ and $M = 3$, with necessary diagrams and expressions. (08 Marks)
 - Using the Gram-Schmidt orthogonalization procedure, find a set of orthonormal basic functions to represent the three signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ shown in Fig.Q3(b). also express each of these signals in terms of the set of basis functions. (08 Marks)

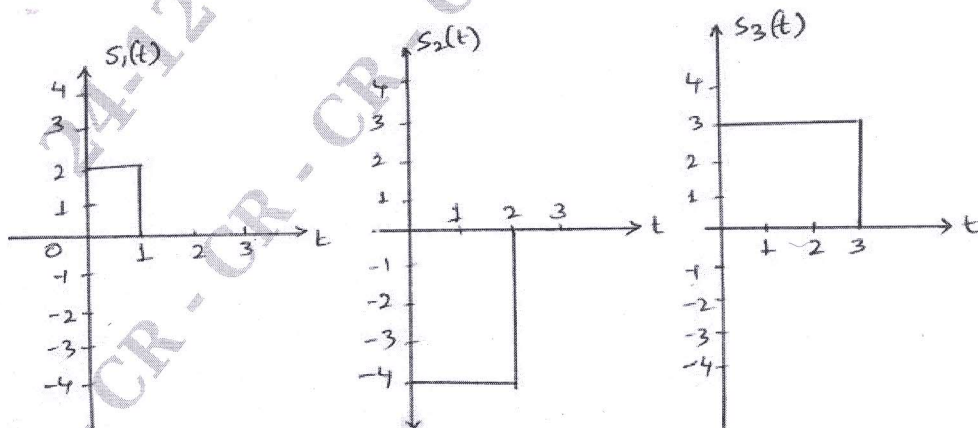


Fig.Q3(b)

OR

- 4 a. Explain the correlation receiver with neat diagrams and explanation of detector and the maximum-likelihood decoder blocks. (08 Marks)
- b. Explain the matched filter receiver. Obtain the expression for the impulse response of the matched filter. (08 Marks)

Module-3

- 5 a. Derive the expression for error probability of binary PSK using coherent detection. (06 Marks)
- b. Binary data are transmitted over a microwave link at the rate of 10^6 bits/sec and the power spectral density of the noise at the receiver input is 10^{-10} W/Hz. find the average carrier power required to maintain an average probability of error $P_e \leq 10^{-4}$ for the following cases.
Binary PSK using coherent detection
DPSK
Note : take $\text{erfc}(2.63) = 2 \times 10^{-4}$, $Q(3.7) = 10^{-4}$. (06 Marks)
- c. Define bandwidth efficiency. Tabulate and comment on the bandwidth efficiency of M-ary PSK signals for different values of M. (04 Marks)

OR

- 6 a. With neat diagram and expressions, explain binary FSK generation and non-coherent detection scheme. (06 Marks)
- b. Explain the generation and optimum detection of differential phase-shift keying with neat block diagram. (06 Marks)
- c. What is the advantage of M-ary QAM over M-ary PSK system? Obtain the constellation of QAM for $M = 4$ and draw signal space diagram. (04 Marks)

Module-4

- 7 a. With a neat block diagram, explain the digital PAM transmission through band limited baseband channels. Also obtain the expression for inter symbol interference. (06 Marks)
- b. Explain the modified duo-binary signaling scheme, with pre-coding. Illustrate the encoding for the binary sequence "011100101". Assume previous pre-coder outputs as 1. (07 Marks)
- With neat diagram, explain the timing features pertaining to eye diagram and its interpretation for baseband binary data transmission system. (03 Marks)

OR

- 8 a. With neat sketches and expressions, explain raised cosine spectrum solution to reduce ISI. (06 Marks)
- b. What is the advantage of controlled ISI partial response signaling scheme? With block diagram, explain the duo-binary encoder with pre-coder. Mention the frequency response, impulse response and its features. (06 Marks)
- c. With neat diagram and relevant expressions, explain the concept of adaptive equalization. (04 Marks)

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Module-5

- 9 a. Explain the working of Direct Sequence Spread Spectrum transmitter and receiver with neat diagram, waveform and expressions. (08 Marks)
- b. A slow frequency Hopped/MFSK system has the following parameters,
i) The number of bits/MFSK symbol = 4
ii) The number of MFSK symbols per hop = 5
iii) Calculate the processing gain of the system in decibels. (03 Marks)
- c. List and briefly explain any 3 applications of direct sequence spread spectrum. (05 Marks)

OR

- 10 a. With a neat block diagram, explain frequency Hopped spread spectrum technique. Explain the terms chip rate, Jamming Margin and processing gain. (08 Marks)
- b. What is a PN sequence? Explain the generation of maximum-length sequences (ML-sequence). What are the properties of ML sequences? (04 Marks)
- c. In a DS/BPSK system, the feedback shift register used to generate the PN sequence has length $m = 19$. The system is required to have an average probability of symbol error due to externally generated interfering signals that does not exceed 10^{-5} . Calculate the following system parameters in decibels :
i) Processing gain
ii) Antijam margin
(Assume $Q(4.25) = 10^{-5}$ or $\text{erfc}(3) = 2 \times 10^{-5}$). (04 Marks)

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