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Roll No.

FIRST SEMESTER

M.Tech.[MOCE]

SUPPLEMENTARY EXAMINATION

(FEB.-2019)

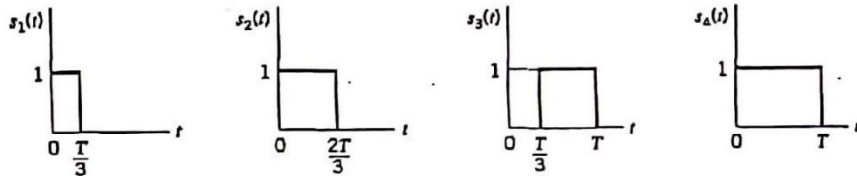
EC-501 ADVANCED COMMUNICATION SYSTEMS

Time: 3:00 Hrs

Max. Marks: 100

Note: Attempt All Questions.
Assume suitable missing data, if any.

- Q1. (a) Describe the Gram Schmidt orthogonalization procedure and find out the constellation diagram or signal space diagram for the following signals: [10]



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- (b) Define Autocorrelation function of a wide sense stationary (WSS) random process and mention its properties? [5]
- (c) Attempt any one of the following [5]
- 1) Consider a sinusoidal signal with random phase defined by [5]
- $$X(t) = A \cos(2\pi f_c t + \theta)$$
- Where A and f_c are constants and θ is a random variable that is uniformly distributed over the interval $[-\pi, \pi]$. Find out mean and autocorrelation of this random process and comment whether it is a WSS process.
- 2) Define Ergodic processes and find out the expression for ensemble mean of the output $Y(t)$ of an LTI system $h(t)$ with a stationary random process $X(t)$ as its input. [5]
- Q2. (a) Define matched filter and find out the expression of the impulse response $h(t)$ of the matched filter for an input signal $s(t)$ of duration 0 to T secs. [10]
- (b) Define the following with suitable illustrations: [5]
- 1). Scalar Quantization 2). Vector Quantization
- (c) Attempt any one of the following [5]
- 1) Define Rate Distortion theorem. [5]

2) Define Quadrature Amplitude Modulation (QAM). [5]

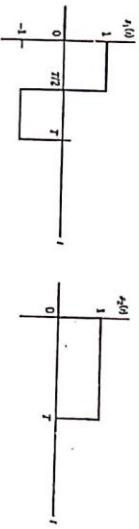
3. a) Explain in detail, the Pulse Code Modulation (PCM) with the help of a block diagram. Find out the output signal-to-quantizing-noise ratio $(S/N)_q$ in a PCM system for a full-scale sinusoidal modulating signal with amplitude A and indicate the increase in $(S/N)_q$ in dB per bit.
 b) Encode the following sequence using the Lempel Ziv source coding algorithm
 01000011000001010000001100000010100001001001

(c) Attempt any one of the following:

- 1). Encode the following alphabet consisting symbols (A,B, C, D, E, F, G) with corresponding probabilities (3/8, 3/16, 3/16, 1/8, 1/16, 1/32, 1/32) using Huffman coding algorithm and find out the efficiency of the coding scheme. [5]
- 2). Define Mutual Information with suitable expressions and show that [5]

$$H(X|Y) = \sum_y p(y)H(X|Y=y)$$

4. (a). Describe the M-ary Pulse Amplitude Modulation along with its signal space diagram. [5]
- (b). Binary information is transmitted using baseband signals of the form shown as [10]



Where $T=8$ msec. Design a correlation receiver and find the probability of error if the channel is considered as AWGN channel with noise power spectral density 10^{-3} watt/Hz. Derive all the necessary expressions.

(c) Attempt any one of the following

- 1). Find out the BER expression for the Coherent Binary Phase Shift Keying (CBPSK) based on the Maximum A Posteriori Probability (MAP) detector along with its signal space diagram depicting the decision boundary. [5]

2). Determine the power spectral density of the Coherent Binary Phase Shift Keying (CBPSK) scheme and draw its power spectra. [5]

Q5. (a). Explain following multiple access techniques with suitable illustrations: [10]

- 1). Time Division Multiple Access (TDMA)
- 2). Frequency Division Multiple Access (FDMA)
- 3). Code Division Multiple Access (CDMA)

(b). Explain Direct Sequence Spread Spectrum (DSSS) with coherent binary phase shift keying with the help of block diagram of transmitter and receiver. [5]

(c). Attempt any one of the following

- 1). Mention the advantages and disadvantages of multipath propagation phenomenon in wireless communication and explain how does it cause various types of fading? [5]
- 2). Figure below shows a four-stage feedback shift register used to generate a PN sequence. The initial state of the register is 1010. Find the output sequence of the shift register and determine whether it generates a maximal length PN sequence? [5]

