Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: EC302

Course Name: Digital Communication

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks Marks

1 a) Prove that sampled signal can be reconstructed by passing the samples through a low pass filter. (8)

b) If X(t) is a random process with mean 3 and autocorrelation of $9+4e^{-0.2\tau}$. Find the mean square value of the random process X(t). (4)

c) Determine the Nyquist rate and Nyquist sampling interval for the signal, $g(t) = \text{sinc}^2 100t$. (3)

2 a) Derive the impulse response and frequency response of modified duobinary encoder. (6)

b) A signal $g(t) = 2\cos 400\pi t + 6\cos 640\pi t$ is ideally sampled at $f_s = 500$ Hz. If the sampled signal is passed through an ideal LPF with a cut-off frequency of 400 Hz, what frequency components will appear in the filter output? (5)

c) Explain different line coding schemes with neat sketches. (4)

3 a) What is raised cosine spectrum? (4)

b) A sinusoidal voice signal $g(t)=\cos 6000\pi t$ is to be transmitted using either PCM or DM. The sampling rate for PCM is 8 kHz and for transmission with DM, the step size is decided to be 31.25 mV. The slope overload distortion is to be avoided in DM. Assuming that the number of quantization levels for the PCM system is 64. Determine the bit rate. Which scheme is to be chosen for this application, PCM or DM? (5)

b) Explain the distortions associated with Delta modulation. (6)

PART B

Answer any two full questions, each carries 15 marks

4 a) Two functions $s_1(t)$ and $s_2(t)$ are given in Fig. 1 (7)

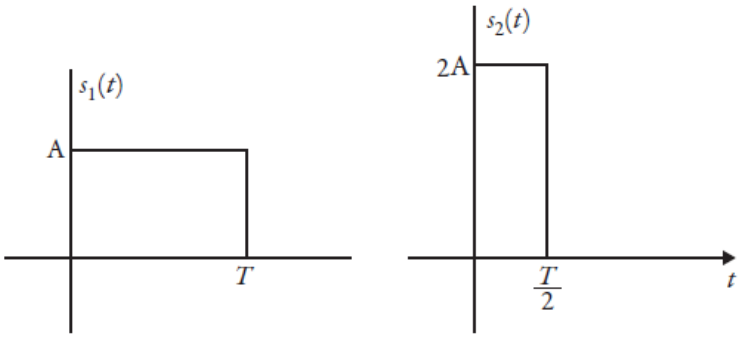

Fig. 1: $s_1(t)$ and $s_2(t)$

(1) Using the Gram–Schmidt orthogonalization procedure, express these functions in terms of orthonormal functions.

(2) Sketch $\phi_1(t)$ and $\phi_2(t)$.

b) Derive mean and variance of received signal x(t) at the output of j^{th} correlator, if $x(t) = s_i(t) + w(t)$. (5)

c) Distinguish between MAP rule and Maximum likelihood rule. (3)

5 a) Derive the bit error probability for QPSK. (8)

b) Draw the constellation diagram for QPSK modulation and explain the generation and detection of QPSK signals with the help of block diagrams. (7)

6 a) Discuss maximum likelihood decoding of signals in noise. (8)

b) Derive an expression for probability of error for BFSK (7)

PART C

Answer any two full questions, each carries 20 marks

7 a) Explain the block diagram for FHSS and distinguish between SFHSS and FFHSS. (10)

b) Define Jamming Margin(JM). (4)

c) A PN sequence generator used a linear feedback shift register with 10 stages and the chip rate is 10^7 per seconds. Find (a) PN sequence length, (b) chip duration of PN sequence, and (c) time period of PN sequence. (6)

8 a) Distinguish between flat fading and frequency selective fading. (5)

b) Explain different diversity techniques. (10)

c) In DSSS-CDMA, the data rate R_b= 6 kbps and the chip rate R_c = 12 Mbps. What is the JM if an output SNR of 10 dB is required for a $P_c = 10^{-5}$. Also, find the JM if we include a system loss of 1.5 dB owing to imperfections in tracking and detection. (5)

9 a) Explain Rake Receiver with a neat diagram. (10)

b) Explain the block diagram for OFDM. (10)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION(S), DECEMBER 2019

Course Code: EC302

Course Name:Digital Communication

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks Marks

1 a) Derive the expression for the normalised power of quantization error in a PCM system with uniform quantization. (8)

b) Explain how eye pattern is used to study the performance of a data transmission system? (7)

2 a) The signal $x(t) = cos(200\pi t) + 0.25cos(700\pi t)$ is sampled at a rate of 400 samples per second. The sampled waveform is then passed through an ideal low pass filter with 200Hz bandwidth. Write the expression for the filter output. Sketch the frequency spectrum of the sampled waveform. (7)

b) Evaluate the power spectral density of unipolar NRZ code. Plot the spectrum. (8)

3 a) Explain the need for a pre-coder in a duo-binary signalling system. For the given input binary data 1011101, obtain the output of the duobinary encoder. Explain how the data can be detected at the receiver. (8)

b) With necessary expressions, explain the practical difficulties encountered in ideal Nyquist channel & how they are overcome by raised cosine filters. (7)

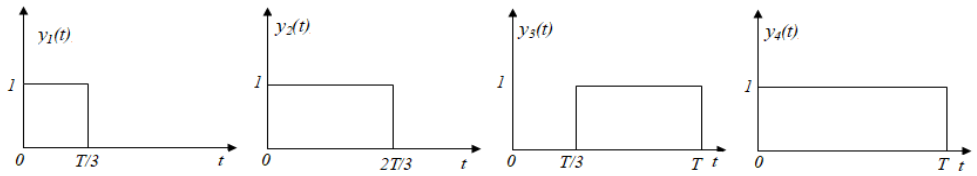
PART B

Answer any two full questions, each carries 15 marks

4 a) Explain in detail, the principle of correlation receiver. (7)

b) With the help of diagrams, explain the working of BPSK transmitter &receiver. (8)

5 Consider the signals $y_1(t), y_2(t), y_3(t) \& y_4(t)$ given below. (15)



Find the orthonormal basis for these set of signals using Gram-Schmidt orthogonization procedure.

6 Derive the expression for probability of error in BFSK. (15)

PART C

Answer any two full questions, each carries 20 marks

7	a)	Explain the importance of PN sequence in spread spectrum communication.Differentiate between fast frequency hopping and slow frequency hopping.	(10)
	b)	What are diversity techniques? Explain how they are implemented intime, space& frequency.	(10)
8	a)	Explain the techniques for generation of PN sequences. What are the properties of PN sequences?	(10)
	b)	Derive the expression for processing gain of MFSK. A fast frequency hopping MFSK system has the following parameters. Number of bits per MFSK symbol=8, Number of hops per MFSK symbol= 8. Calculate the processing gain.	(10)
9	a)	Explain the difference between coherence bandwidth and coherence time.	(4)
	b)	Discuss synchronisation techniques.	(6)
	c)	With relevant block schematic, explain how a RAKE receiver can improve theperformance of CDMA communication system.	(10)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth semester B.Tech examinations (S), September 2020

Course Code: EC302

Course Name: Digital Communication

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks Marks

1 a) With the help of suitable block diagrams explain differential pulse code modulation. How does it differ from PCM and delta modulation? (8)

b) With the help of block diagram, explain modified duobinary signalling scheme. (7)

2 a) Define sampling. Differentiate different types of sampling. With relevant derivation explain how to obtain samples from a message signal. (7)

b) Given the data stream 1110010100, sketch the transmitted sequence of pulses for each of the following line codes: (3)

1) Unipolar nonreturn-to-zero
2) Polar nonreturn-to-zero
3) Manchester code

c) Explain eye pattern and its significance. (5)

3 a) Prove the following two properties of autocorrelation function $R_X(\tau)$ of a random process $X(t)$: (6)

1) If $X(t)$ contains a DC component equal to A, then $R_X(\tau)$ will contain a constant component equal to A^2.
2) If $X(t)$ contains a sinusoidal component, then $R_X(\tau)$ will also contain a sinusoidal component of the same frequency.

b) Derive the necessary condition to be satisfied by a delta modulator to avoid slope overload distortion if the input is a sine wave of frequency f_m and amplitude A_m. (4)

c) With the help of necessary mathematical expressions explain inter symbol interference (ISI). (5)

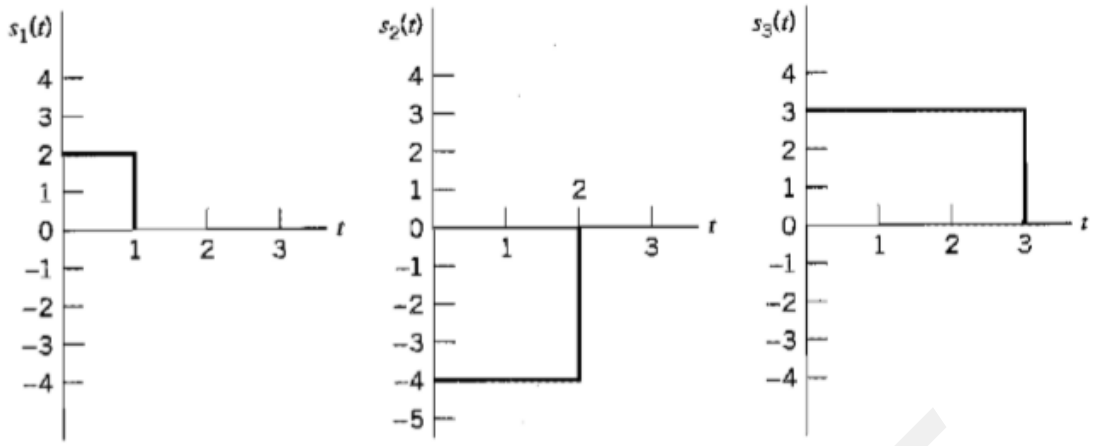
PART B

Answer any two full questions, each carries 15 marks

4 a) Draw the constellation diagram for BFSK modulation and explain the generation and detection of BFSK signals with the help of block diagrams. (8)

b) Derive an expression for probability of error for BFSK. (7)

5 a) Using Gram Schmidt orthogonalization procedure, find the orthonormal basis functions for the signals $s_1(t), s_2(t), s_3(t)$ shown in the figure below (9)



b) Explain correlation receiver with the help of suitable block diagrams (6)

6 a) With the help of diagrams explain a non-coherent modulation scheme. (8)

b) Explain Maximum Likelihood Decoding. (7)

PART C

Answer any two full questions, each carries 20 marks

7 a) With suitable block schematic, explain RAKE receiver and its relevance in CDMA systems. (9)

b) What is spread spectrum modulation? Explain its significance and applications in the field of communication. (6)

c) Explain the significance of PN sequences and explain the properties of PN sequences. (5)

8 a) With the help of relevant diagrams, explain OFDM. (10)

b) 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 in decibels: (i)Processing gain;(ii)Anti-jam margin (10)

9 a) Explain the various multiple access schemes. (8)

b) With the help of relevant block schematics, explain frequency hopping spread spectrum with MFSK. Distinguish between SFHSS and FFHSS (10)

c) What are Gold codes? (2)

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