Reg No.:_____                                    Name:_____

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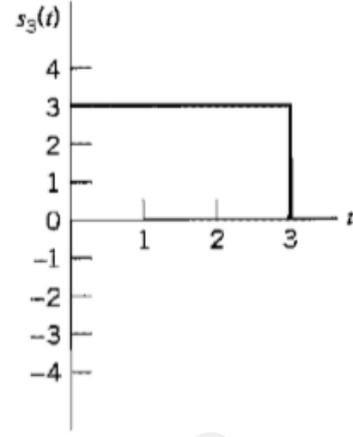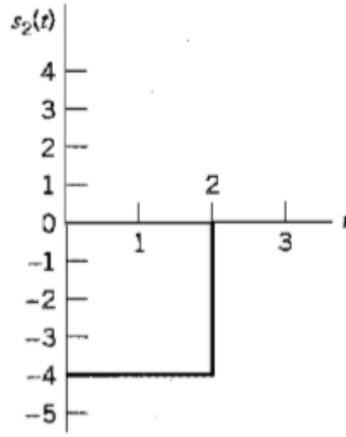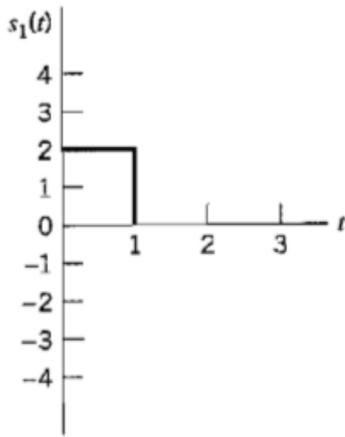
b) Explain correlation receiver with the help of suitable block diagrams (6)

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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