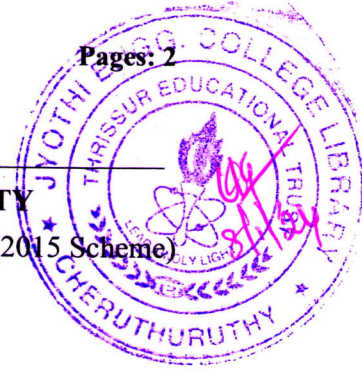


Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S, FE) / S4 (PT) (S, FE) Examination January 2024 (2015 Scheme)

**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) Explain the basic elements of a Pulse code modulation system with neat block schematic. (7)
- b) The output of an oscillator is described by $X(t) = A \cos(2\pi ft - \Phi)$; where A is a constant, f and Φ are independent random variables. Probability density function Φ is defined as
- $$f_{\Phi}(\theta) = \begin{cases} \frac{1}{2\pi} & ; 0 \leq \theta \leq 2\pi \\ 0 & ; \text{otherwise} \end{cases}$$
- Find the power spectral density of $X(t)$ in terms of probability density function of frequency? What happens to power spectral density when the frequency f assumes a constant value?
- 2 a) Derive the expression for the mean square value of the output random process when the input random process $X(t)$ is applied to a linear time invariant filter? (7)
- b) With the help of equations show that the impulse response of the Matched filter is matched to the input signal. Explain the properties of Matched filter. ? (8)
- 3 a) Explain the features of ideal Nyquist channel with neat sketches. Is there any practical difficulty to implement ideal Nyquist channel? If so, how do we overcome the same? (10)
- b) What is the significance of correlative level coding? Describe any one method which implements correlative level coding. (5)

PART B*Answer any two full questions, each carries 15 marks*

- 4 a) Explain signal space representation of the QPSK with the proper equations. Illustrate the sequence and waveforms involved in the generation of the QPSK signal for the input binary sequence 01101000. (10)
- b) Define likelihood function and the log likelihood function. (5)
- 5 a) What is meant by correlation receiver.? Explain the demodulator and the signal transmission decoder of the correlation receiver with neat sketches. Show that the (10)

detector part of the optimum receiver can be implemented using bank of matched filter?

- b) Write short note on DPSK (5)
- 6 a) Consider the four signals $s_1(t)$, $s_2(t)$, $s_3(t)$ and $s_4(t)$ given by the relation $s_i(t) = \sqrt{2P_s} \cos \left[w_0 t + (2i - 1) \frac{\pi}{4} \right]; i=1,2,3,4$ for $0 \leq t \leq T$. Assume $2w_0T = n\pi$. (8)
- a) Find a set of orthonormal coordinates
- b) Plot the four signals using the orthonormal coordinates.
- b) Explain the generation and detection of coherent BPSK signals with neat sketches. (7)
- Write the expression for the average probability of symbol error for BPSK?

PART C

Answer any two full questions, each carries 20 marks

- 7 a) Briefly explain various diversity techniques used in the wireless communication system? (10)
- b) Define coherence time and coherence bandwidth defined in a wireless communication system.? (5)
- c) What is meant by Jamming Margin? Write the expression for Jamming margin in dB.? (5)
- 8 a) Compare the performance of CDMA, TDMA, FDMA and SDMA? (10)
- b) A PN sequence is generated using a feedback shift register of length $m=4$. The chip rate is 10^7 chips per second. Find the following parameters. (6)
- i) PN sequence length
- ii) Chip duration of PN sequence
- iii) PN sequence period
- c) Define the processing gain in a CDMA system with suitable equation. (4)
- 9 a) Explain the generation of PN sequence with a proper example (8)
- b) Explain the working of frequency hop spread M-ary frequency shift keying transmitter and receiver with neat block schematic. (8)
- c) Write note on Gold codes (4)
