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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S, FE) / S3 (PT) (S) Examination June 2024 (2019 Scheme)

Course Code: ECT 305

Course Name: ANALOG AND DIGITAL COMMUNICATION

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1		Discuss the need for modulation in communication system.	3
2		Calculate the percentage of power saving in DSBSC and SSB AM compared to conventional AM (DSBFC) when all were modulated at a depth of 100% .	3
3		Explain the concepts of amount of information and entropy.	3
4		Define the autocorrelation function of a random process X(t).	3
5		What is Companding in PCM? Explain any one method with necessary plots.	3
6		Explain how delta modulation become advantageous than PCM and DPCM.	3
7		Distinguish between MAP rule and maximum likelihood rule.	3
8		The output of a duobinary encoder is -2 0 0 0 2 0 -2. Find the transmitted data sequence.	3
9		Differentiate between coherent and non-coherent digital modulation schemes. Give example for both schemes.	3
10		Draw the signal constellation diagram of 16-QAM and explain briefly.	3

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11	a)	Derive the mathematical expression for amplitude modulation and draw the frequency spectrum of AM wave.	9
	b)	An AM wave with carrier 10Vand 100 kHz is modulated by modulating signal of amplitude 7V, 5kHz. Write the mathematical equation for the obtained AM wave. Plot the frequency spectrum with accurate scale.	5
12	a)	What is SSB in AM? Explain phase shift method of SSB generation.	9
	b)	An FM wave is represented as $v = 12 \sin (6 \times 10^8 t + 5 \sin 1250t)$. Find its carrier frequency, modulating frequency, modulation index and maximum deviation (δ_{max}).	5

Module -2

13 a) Derive the expression for differential entropy of a Gaussian random variable Y. 7

b) A source emits one of the four symbols s_0, s_1, s_2, and s_3 with probabilities $\frac{1}{3}$, $\frac{1}{6}$, $\frac{1}{4}$, and $\frac{1}{4}$ respectively. The successive symbols emitted by the source are statistically independent. Calculate the entropy of the source. 7

14 a) State and explain properties of the Power Spectral Density (PSD) of a stationary random process X(t). 7

b) Find the Power Spectral Density (PSD) of a sinusoidal process with random phase $X(t) = A\cos(2\pi f_c t + \theta)$ 7

Module -3

15 a) Draw the block diagram of a PCM transmitter and receiver system. Explain each block. 9

b) State and explain sampling theorem. 5

A PCM system uses a uniform quantizer followed by an 8 bit encoder. If the bit rate of the system is 10^8 bps, then what is the maximum bandwidth of the low-pass message signal for which the system operates satisfactorily?

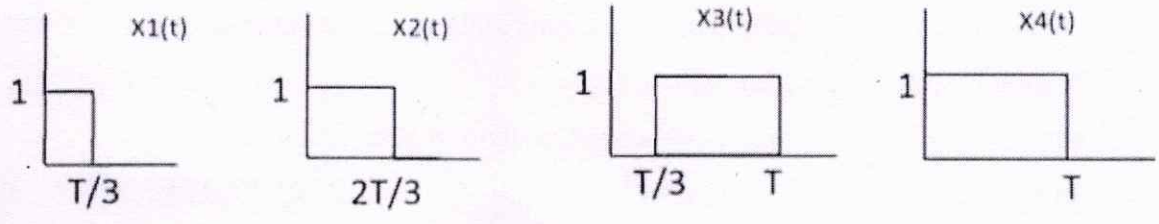
16 a) Draw the block diagram of transmitter and receiver of a Delta Modulator. Explain each block. 9

b) A linear delta modulator is designed to operate on speech signals limited to 3.4 kHz. The sampling rate is 10 times the Nyquist rate of the speech signal. The step size δ is 100 mV. The modulator is tested with a 1kHz test signal. Find the maximum amplitude of this test signal required to avoid slope overload. 5

Module -4

17 (i) The signals X1(t), X2(t), X3(t) and X4(t) are given as shown in Figure. Use the Gram-Schmidt orthogonalization procedure to express these functions in terms of orthonormal basis functions. 14

(ii) Sketch the basis functions.



18 With the help of necessary mathematical expressions explain inter symbol interference. Explain how it can be rectified using a raised cosine filter. 14

Module -5

19 a) Draw the block diagram of BPSK generation and detection. Explain it with relevant equations. 10

b) Draw the signal constellation diagram of QPSK and explain it briefly. 4

20 a) Draw the BER v/s SNR plot for the BPSK system and explain the graph. 4

b) Derive the expression for probability of error in QPSK . 10

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