Reg No.:_____ Name:_____

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Fifth Semester B.Tech Degree Examination December 2021 (2019 scheme)

**Course Code: ECT305**

**Course Name: ANALOG AND DIGITAL COMMUNICATION**

Max. Marks: 100 Duration: 3 Hours

**PART A**

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

1 Compare AM, DSB-SC and SSB-SC modulation schemes with respect to bandwidth and system complexity. (3)

2 With suitable block diagram explain the generation of wideband FM using narrow band FM. (3)

3 Describe the concept of mutual information. Write the expressions for the same. (3)

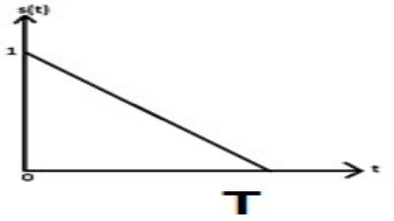
4 Let X be a continuous random variable with the following probability density function $f(x) = \begin{cases} ke^{-4x} & x \geq 0 \\ 0 & otherwise \end{cases}$. Find the value of the constant k. (3)

5 Discuss any one non uniform quantization methods? (3)

6 Discuss the need of regenerative repeater in PCM system. (3)

7 State the Nyquist criterion for distortionless baseband transmission in the absence of noise. (3)

8 The input to the matched filter is given below. (3)




Determine the impulse response of the matched filter.

9 Draw the block diagram of a coherent binary PSK receiver. (3)

10 Draw the BER v/s SNR plot for the BPSK system and explain the graph. (3)

## PART B

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

### Module -1

11 a) Derive the modulation index of AM wave in terms of $V_{max}$ and $V_{min}$ . A sinusoidal carrier signal of peak amplitude 5 V and frequency 100 kHz is amplitude modulated by a 5 kHz signal of peak amplitude 3 V. Plot the modulated wave with $V_{max}$ and $V_{min}$ indicated also calculate modulation index. (6)

b) An AM signal $s(t) = 10(1 + 0.8\cos(2\pi 10^3 t))\cos(2\pi 10^6 t)$ is radiated to free space by an antenna having the resistance of 1Ω. Draw the spectrum of $s(t)$. Also calculate the power and bandwidth. (8)

OR

12 a) With supporting equations and block diagram, explain the SSB-SC modulated signal generation. (6)

b) A carrier wave of frequency 100 $MHz$ is frequency modulated by a sinusoidal wave of amplitude 20 volts and frequency 100 kHz. The frequency sensitivity of the modulator is 25kHz per volt. Determine the approximate bandwidth of the FM signal, using Carson's rule. What will happen to bandwidth if modulating signal amplitude and frequency are doubled? (8)

### Module -2

13 a) Find entropy of a binary memoryless source emitting two equally probable messages. (4)

b) Define autocorrelation function of a random process and state its properties. Also show that the autocorrelation function $R_X(\tau)$ contains a constant component equal to $A^2$ if a random process $X(t)$ contains a dc component equal to $A$. (10)

OR

14 a) Derive the expression for differential entropy of a Gaussian random variable X with mean μ and variance $\sigma^2$. (4)

b) Discuss the properties of power spectral density of a WSS process. Find power spectral density of the WSS random process if its autocorrelation function is given by $R_X(\tau) = e^{-\alpha|\tau|}\ for -\infty < \tau < \infty$ (10)

### Module -3

15 a) With suitable block diagram explain differential pulse code modulation transmitter system. How does it differ from PCM and delta modulation? (8)

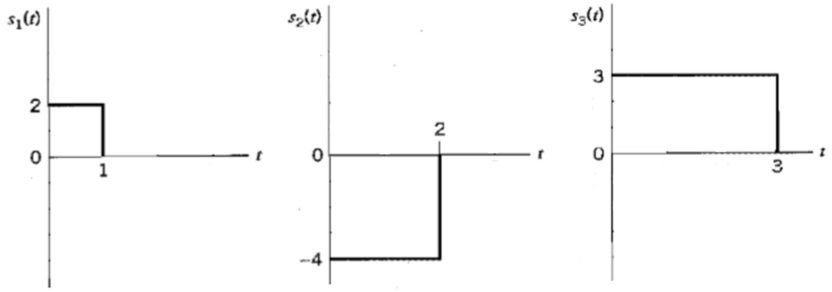
b) The input to the delta modulator is a sinusoidal signal whose frequency varies from 500 Hz to 5000 Hz. The sampling rate is 4 times the Nyquist rate. The signal peak amplitude is 1 V. Determine the step size when the sampling frequency is 1000 Hz. (6)

OR

16 a) A stationary process X(t) has the following values for its autocorrelation functions . $R_X(0) = 1, R_X(1) = 0.8, R_X(2) = 0.6\ and\ R_X(3) = 0.4$ . Calculate the coefficients of an optimum linear predictor involving the use of 2 unit-delays. 14

**Module -4**

17 a) Consider the signals $s_1(t), s_2(t)\ and\ s_3(t)$ given below. Find the orthonormal basis for these set of signals using Gram-Schmidt orthogonalization procedure.




(14)

OR

18 a) With the help of neat diagram derive the impulse response and frequency response of duobinary encoder. (14)

**Module -5**

19 a) Derive the expression for probability of error in BPSK. (14)

OR

20 a) Draw the constellation diagram for QPSK modulation and explain the generation and detection of QPSK signals with the help of block diagrams. (14)

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