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Total Number of Pages: 02

Course: IDD(B.Tech & M.Tech)

Sub_Code: REC5C002

5th Semester Regular/Back Examination: 2024-25
SUBJECT: ANALOG AND DIGITAL COMMUNICATION
BRANCH(S): ECE, ELECTRONICS & C.E, ETC, ECE

Time: 3 Hours

Max Marks: 100

Q.Code: R122

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- What is the Dirichlet's condition in Fourier Transform?
- A 10 MHz carrier is frequency-modulated by a 500 Hz sinusoidal signal, with a maximum frequency deviation of 50 kHz. Determine the system's bandwidth.
- What is wide sense stationary process?
- What is pulse modulation? Describe the different types of pulse modulation?
- Draw the constellation diagram for QPSK system.
- What is Inter symbol Interference (ISI)?
- Describe the working principle of an envelope detector used in an amplitude modulation (AM) scheme.
- Find the Nyquist rate of $x(t) = 10 \cos(2000\pi t) + 20 \sin(8000\pi t) + 4 \cos(4000\pi t)$.
- What is quadrature null effect in coherent demodulation?
- Explain the concepts of mean and variance for a continuous random variable.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

a) A random variable having cumulative density function (CDF) (3+3)

$$F_X(x) = \begin{cases} 0 & -\infty \leq x < 0 \\ kx^2 & 0 \leq x \leq 10 \\ 100k & x > 10 \end{cases}$$

- Find the value of k ?
 - Find the probability of $P(x \leq 5)$?
- Derive the expression for Figure of Merit of DSB-SC receiver. 6
 - Discuss maximum likelihood sequence detection principle. 6
 - What are the issues associated with delta modulation, and how can they be resolved? 6
 - The antenna of a transmitter is 10 Amp when the carrier signal alone is transmitted. It increases to 12 Amp when the carrier is sinusoidally modulated calculate the modulation index and modulation efficiency. (3+3)

- f) Explain equalization technique for a standard communication set up. 6
- g) Describe match filter with expressions. 6
- h) What is MSK? Write the advantages and disadvantages as compare to QPSK Modulation. 6
- i) Describe the AM superheterodyne receiver. 6
- j) What is energy and power signal? Write the difference between energy spectral density and power spectral density? 6
- k) Describe the Costas's receiver? 6
- l) What is modulation? Consider the frequency modulated signal $x(t) = 10 \cos [2\pi \times 10^5 t + 5 \sin(2\pi \times 1500 t) + 7.5 \sin(2\pi \times 1000 t)]$ with a carrier frequency of 10^5 Hz. Find the modulation index. (2+4)

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** a) Find the probability of error of BPSK reception using coherent/match filter detection. (12+4)
- b) Find the probability of error of 8-PSK at $\frac{E_{av}}{N_0} = 13$ dB. (Use the Chernoff bound, Hint: Probability of error for M-PSK $P_e \approx 2 Q \left(\sqrt{\frac{2E_s}{N_0}} \sin \frac{\pi}{M} \right)$).
- Q4** a) Describe the PCM system with block diagram? (10+3+3)
- b) In a binary PCM system, the output signal-to-quantizing-noise ratio is to be held to a minimum value of 20 dB. Determine the number of required levels and find the corresponding output signal to quantizing noise ratio.
- c) Find the minimum bandwidth of the system if the maximum frequency of the baseband signal is 4KHz.
- Q5** a) Write the definition and mathematical representation of Phase Modulation (PM) and Frequency Modulation (FM). (8+8)
- b) Describe the relationship between PM and FM with block diagram.
- Q6** Explain the function of a Viterbi receiver in digital communication systems. (16)