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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)

- a) What is the Dirichlet's condition in Fourier Transform?
- b) 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.
- c) What is wide sense stationary process?
- d) What is pulse modulation? Describe the different types of pulse modulation?
- e) Draw the constellation diagram for QPSK system.
- f) What is Inter symbol Interference (ISI)?
- g) Describe the working principle of an envelope detector used in an amplitude modulation (AM) scheme.
- h) Find the Nyquist rate of $x(t) = 10 \cos(2000\pi t) + 20\sin(8000\pi t) + 4\cos(4000\pi t)$.
- i) What is quadrature null effect in coherent demodulation?
- j) 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)

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

- i) Find the value of k ?
- ii) Find the probability of $P(x \leq 5)$?

b) Derive the expression for Figure of Merit of DSB-SC receiver. 6

c) Discuss maximum likelihood sequence detection principle. 6

d) What are the issues associated with delta modulation, and how can they be resolved? 6

e) 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 $x(t) = 10 \cos [2\pi \times 10^5 t + 5 \sin(2\pi \times 1500t) + 7.5 \sin(2\pi \times 1000t)]$ 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 $Pe \approx 2 Q \left(\sqrt{\frac{2E_s}{N_0}} \sin \frac{\pi}{M} \right)$).	
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 base band 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)