GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2020-2021
ANALOG AND DIGITAL COMMUNICATION SYSTEMS
EC501

TIME ALLOTTED: 3 Hours   **FULL MARKS: 70**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)
Answer any *ten* from the following, choosing the correct alternative of each question: **10×1=10**

			Marks	CO No
1.	(i)	Two sinusoidal signals are simultaneously modulating a carrier, the modulation indices being 0.3 and 0.4. The overall modulation index is a) 0.5 b) 0.1 c) 0.7 d) 0.12	1	CO5
	(ii)	The envelope detector is a/an a) Synchronous detector b) Asynchronous detector c) Product demodulator d) Coherent detector	1	CO4
	(iii)	A box contains 3 red, 4 white and 5 black balls. One ball is drawn at random. The probability that it is black or white is a) 1/4 b) 3/4 c) 5/12 d) 7/12	1	CO3
	(iv)	The sequence of operations in which PCM is done is a) Quantizing, encoding, sampling b) Quantizing, sampling, encoding c) Sampling, quantizing, encoding d) None of the above	1	CO1
	(v)	Characteristics of Matched filter are a) Matched filter is used to maximize Signal to noise ratio even for non Gaussian noise b) It gives the output as signal energy in the absence of noise c) They are used for signal detection d) All of the above	1	CO2

			Marks	CO No
(vi)	Eye pattern is used to study a) Bit error rate b) Error vector magnitude c) Quantization noise d) Inter Symbol Interference		1	CO3
(vii)	The probability of error of DPSK is _____ than that of BPSK. a) Higher b) Lower c) Same d) Not predictable		1	CO4
(viii)	For a line code, the transmission bandwidth must be a) Maximum possible b) As small as possible c) Depends on the signal d) None of the above		1	CO3
(ix)	The format in which the positive half interval pulse is followed by a negative half interval pulse for transmission of '1' is a) Polar NRZ format b) Bipolar NRZ format c) Manchester format d) None of the above		1	CO5
(x)	Constellation diagram is plotted in a) Constellation space b) Signal space c) Orthogonal space d) Boundary space		1	CO3
(xi)	The interference caused by the adjacent pulses in digital transmission is called a) Inter symbol interference b) White noise c) Image frequency interference d) Transit time noise		1	CO5
(xii)	Minimum shift keying is similar to a) Binary phase shift keying b) Binary frequency shift keying c) Continuous phase frequency shift keying d) QPSK		1	CO1

GROUP – B[*]
(Short Answer Type Questions)
Answer any *three* from the following:**3×5=15**

			Marks	CO No
2.	(a)	The PDF of amplitude X of a certain signal $x(t)$ is given by $f_X(x) = 0.5|x|e^{-|x|}$ Determine: $F(X \geq 1)$	3	CO3
	(b)	State the reason of importance of Gaussian random variable.	2	CO4

3.	(a)	What are the advantages of adaptive-delta modulation over ordinary delta-modulation?	3	CO1
	(b)	What is the function of frame synchronizing bit in a T-1 digital system?	2	CO3
4.		Calculate the signal to noise ratio at the output of a synchronous SSB-SC demodulator.	5	CO5
5.	(a)	Draw the signal space representation of BFSK and find the distance between symbols.	3	CO2
	(b)	Find the probability of error in Coherent Binary Phase Shift Keying (BPSK).	2	CO2
6.	(a)	Draw the PRZ and AMI coding for d(t)=1001011	2	CO3
	(b)	What are the differences between source coding and line coding?	3	CO4

GROUP – C*
(Long Answer Type Questions)
Answer any *three* from the following:**3×15=45**

			Marks	CO No.
7.	(a)	What do you mean by DSB-SC modulation? Explain the function of balance modulator in DSB-SC generation.	5	CO2
	(b)	Prove that the efficiency of a single tone AM is 33.3% for perfect modulation. Discuss about the roles of pre-emphasis circuit in FM broadcasting.	5	CO3
	(c)	What is Carson Rule? A frequency-modulated signal is represented as follows: $e_{FM} = 10\sin(16\pi \times 10^6 t + 20\sin 2\pi \times 10^3 t)$ volts. Determine modulation index and frequency deviation.	5	CO5
8.	(a)	What are the significances of orthonormal basis functions for geometric representation of signals?	5	CO5
	(b)	Consider any pair of real-valued energy signals $s_1(t)$ and $s_2(t)$. Prove the *Schwarz inequality* that states: $$\left(\int_{-\infty}^{\infty} s_1(t)s_2(t)dt\right)^2 \le \left(\int_{-\infty}^{\infty} s_1^2(t)dt\right)\left(\int_{-\infty}^{\infty} s_2^2(t)dt\right)$$ When is this relation satisfied with equality sign?	5	CO3
	(c)	Prove that the SNR at the output of a matched filter is $8E_s/\eta$. Where E_s is the signal energy and $\eta/2 = G_n(f)$, for white gaussian noise.	5	CO4
9.	(a)	Explain the principle of operation of QPSK transmitter with suitable block diagram.	6	CO5
	(b)	Draw constellation diagram of QPSK modulation scheme.	5	CO2
	(c)	What is offset QPSK? How it is more advantageous over non-offset QPSK?	4	CO3
10.	(a)	What is Nyquist criterion for Inter-symbol interference?	5	CO5
	(b)	What are the limitations of ideal solution and how it can be solved with the help of Raised Cosine Function?	5	CO3

(c)		A communication channel of bandwidth 75 kHz is required to transmit binary data at a rate of 0.1 Mbps using raised cosine pulses. Determine the roll-off factor.	5	CO2
11.		Writeshort notes on any *three* of the following:	**3x5**	
	(a)	Baseband vs. Carrier Communication	5	CO2
	(b)	Aliasing effect	5	CO1
	(c)	Companding	5	CO5
	(d)	Optimum filter	5	CO3
	(e)	M-ary PSK	5	CO4