

GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2020-2021

DIGITAL COMMUNICATION SYSTEMS (Backlog)**EC 501**

TIME ALLOTTED: 3 Hrs

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) The expression for bandwidth BW of a PCM system, where v is the number of bits per sample and f_m is the modulating frequency, is given by		
a) $BW \geq v f_m$	01	CO5
b) $BW \leq v f_m$		
c) $BW \geq 2v f_m$		
d) $BW \geq \frac{1}{2} v f_m$		
ii) The number of voice channels that can be accommodated for transmission in T1 carrier system is		
a) 24	01	CO4
b) 32		
c) 56		
d) 64		
iii) A random variable is determined by a large number of independent events that tends to have a Gaussian probability distribution. This can be described using		
a) Central limit theorem	01	CO3
b) Superposition		
c) Convolution		
d) Correlation		
iv) In Alternate Mark Inversion (AMI) is		
a) 0 is encoded as positive pulse and 1 is encoded as negative pulse		
b) 0 is encoded as no pulse and 1 is encoded as negative pulse		
c) 0 is encoded as negative pulse and 1 is encoded as positive pulse	01	CO1
d) 0 is encoded as no pulse and 1 is encoded as positive or negative pulse		

v)	Eye pattern is a) Is used to study ISI b) May be seen on CRO c) Resembles the shape of human eye d) All of the above	01	CO2
vi)	For two vectors to be orthonormal, the vectors are also said to be orthogonal. The reverse of the same a) Is true b) Is not true c) Is not predictable d) None of the above	01	CO3
vii)	In Binary Phase Shift Keying system, the binary symbols 1 and 0 are represented by carrier with phase shift of a) $\Pi/2$ b) Π c) 2Π d) 0	01	CO4
viii)	QPSK is a modulation scheme where each symbol consists of a) 4 bits b) 2 bits c) 1 bits d) M number of bits, depending upon the requirement	01	CO3
ix)	Matched filter may be optimally used only for a) Gaussian noise b) Transit time noise c) Flicker d) All of the above	01	CO5
x)	Regenerative repeaters are used for a) Eliminating noise b) Reconstruction of signals c) Transmission over long distances d) All of the above	01	CO3
xi)	The bit rate of a digital communication system is 34 Mb/s. The modulation scheme is QPSK. The baud rate is a) 68 Mbps b) 34 Mbps c) 17 Mbps d) 8.5 Mbps	01	CO5
xii)	The transmission bandwidth of the raised cosine spectrum is given by a) $BW = 2w(1 + \alpha)$ b) $BW = w(1 + \alpha)$ c) $BW = 2w(1 + 2\alpha)$ d) $BW = 2w(2 + \alpha)$	01	CO1

GROUP – B
(Short Answer Type Questions)

(Answer any *three* of the following) **3 x 5 = 15**

		Marks	CO No.
2.	a) The PDF of a Gaussian variable x is given by $f_X(x) = \frac{1}{3\sqrt{2\pi}} e^{-(x-4)^2/18}$ Determine: $F(X \geq 4)$	3	CO1
	b) For the above PDF, Determine: $F(X \leq 0)$	2	CO1
3.	a) What are the advantages of adaptive-delta modulation over ordinary delta-modulation?	3	CO3
	b) What is the bit rate in a T-1 digital system?	2	CO5
4.	a) Draw the signal space representation of BFSK and find the distance between symbols.	3	CO2
	b) Find the probability of error in Phase Shift Keying (PSK).	2	CO2
5.	a) What are the properties of line coding?	2	CO4
	b) What are the advantages and disadvantages of bipolar signaling format? -Explain.	3	CO3
6.	a) For a sinusoidal signal ($A \cos \omega_{mt}$), find the condition for no slope overload, if step size is Δ and sampling period is T_s .	3	CO5
	b) What is the difference between source coding and line coding?	2	CO3

GROUP – C
(Long Answer Type Questions)

(Answer any *three* of the following) **3 x 15 = 45**

		Marks	CO No.
7.	a) Show that the squared length of any signal vector is equal to the energy of the signal.	4	CO3
	b) Figure 1. displays the waveforms of four signals $s_1(t), s_2(t), s_3(t)$ and $s_4(t)$. Using the Gram-Schmidt orthogonalization procedure, find an orthonormal basis function for this set of signals		

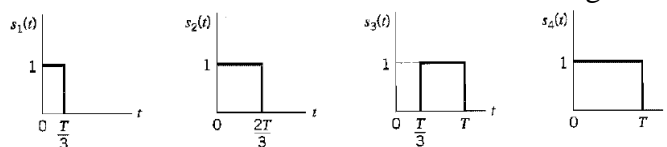


Figure 1

8 CO2

- c) A pair of signals $s_i(t)$ and $s_k(t)$ have a common duration T , show that the inner product of this pair of signals is given by
- $$\int_0^T s_i(t) s_k(t) dt = \mathbf{s}_i^T \mathbf{s}_k$$
- 3 CO2
- Where \mathbf{s}_i and \mathbf{s}_k denote the vector representations of the signals $s_i(t)$ and $s_k(t)$ respectively.
8. a) What do you mean by match filter? 3 CO5
- b) 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. 8 CO1
- And hence deduce the transfer function of a matched filter.
- c) A polar NRZ waveform has to be received with the help of a matched filter. Here a rectangular positive pulse represents binary one and a rectangular negative pulse represents binary zero. Determine the impulse response of the matched filter with proper sketch. 4 CO2
9. 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 RaisedCosine Function? 5 CO4
- 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 CO5
10. a) Explain the principle of operation of QPSK transmitter with suitable block diagram. 7 CO3
- b) Draw constellation diagram of QPSK modulation scheme. 5 CO2
- c) What is offset QPSK? How it is more advantageous over non-offset QPSK? 3 CO2
11. Writeshort notes on any **three** of the following: 3x5=15
- a) Differential PCM 5 CO4
- b) Companding 5 CO1
- c) M-ary PSK 5 CO2
- d) Eye pattern 5 CO3
- e) Vector Signal Analyzer (VSA) 5 CO5