Total No. of printed pages = 4 04/01/23 ECE 181503 BINA CHOWDHURY CENTRAL LIBRARY Roll No. of candidate (GIVIT & GIPS) Azara, Hatkhowapara, Guwahati -781017 2022 B.Tech. 5th Semester End-Term Examination ECE, ETE DIGITAL COMMUNICATION (New Regulation and New Syllabus) Time - Three hours Full Marks - 70 The figures in the margin indicate full marks for the questions. Answer question No. 1 and any four from the rest.  $(10 \times 1 = 10)$ Answer the following MCQ: The bit rate of a digital communication system is R kbits/s. The modulation used is 32-QAM. The minimum bandwidth required for ISI free transmission is R/10 kHz (a) R/10 Hz (d) R/5 Hz (c) R/5 Hz (ii) In a baseband communications link, frequencies upto 3500 Hz are used for signaling. Using a raised cosine pulse with 75% excess bandwidth and for no inter-symbol interference, the maximum possible signaling rate in symbols per second is 2625 (b) (a) 1750 5250 (d) 4000 (iii) A source alphabet consists of 'N' symbols with the probability of the first two symbols being the same. A source encoder increases the probability of the first symbol by a small amount  $\varepsilon$  and decreases that of the second by  $\varepsilon$ . After encoding, the entropy of the source

Turn over

(a) increases

(c)

(d)

(b) remains the same

decreases

increases only if N = 2

(iv)	The	Nyquist sampling rate for th	e sign	nal $s(t) = \frac{\sin(500\pi t)}{\pi t} \times \frac{\sin(700\pi t)}{\pi t}$ is	
	give	n by			
	(a)	400 Hz	(b)	600 Hz	
	(c)	1200 Hz	(d)	1400 Hz	
(v)	A communication channel with AWGN operating at a signal to noise $SNR >> 1$ and bandwidth B has capacity $C_1$ . If the $SNR$ is doubled kee constant, the resulting capacity $C_2$ is given by				
	(a)	$C_2 \approx 2C_1$	(b)	$C_2 \approx C_1 + B$	
	(c)	$C_2 \approx C_1 + 2B$	(d)	$C_2 \approx C_1 + 0.3B$	
(vi)	and	5 V. If the signal to quanti	zation	uniformly distributed between -5 V n noise ratio required in uniformly the step of the quantization is	
0.0	(a)	0.033 V	(b)	0.05 V	
	(c)	0.0667 V	(d)	0.10 V	
(vii) A memory less source emits $n$ symbols each with a probabili entropy of the source as a function of $n$				ols each with a probability P. The	
* 1	(a)	increases as log n		A CHOWDHURY CENTRAL LIBRARY	
	(b)	decreases as $\log(1/n)$	BIN	A-ara Harkhowapara,	
	(c)	increases as n		Guwahati -781017	
	(d)	increases as $n \log n$			
(viii) Noise with double-sided power spectral density on $K$ over all frequencies passed through a $RC$ low pass filter with 3 dB cut-off frequency of $f_c$ . T					
	noise	e power at the filter output is			
	(a)	$K_{-}$	(b)	Kf <sub>c</sub>	
	(c)	$k\pi f_c$	(d)	ω	
(ix)	Consider a Binary Symmetric Channel (BSC) with probability of embeing p. To transmit a bit, say 1, we transmit a sequence of three 1s. Treceiver will interpret the received sequence to represent 1 if at least to bits are 1. The probability that the transmitted bit will be received in emissions.				
	(a)	$p^3 + 3p^2(1-p)$	(b)	$p^3$	
	(c)	$(1-p^3)$	(d)	$p^3 + p^2(1-p)$	

(x)	Four messages band limited to W,W, 2W and 3W respectively are to be				
E S	multiplexed using Time Division Multiplexing (TDM). The minimum				
	bandwidth required for transmission of this TDM signal is				
	(a) W (b) 3W				
	(c) 6W (d) 7W				
(a)	Draw the block diagram of elements of a digital communication system and explain the function of each block.				
(b)	Explain the Sampling process.				
(c)	What are the two major sources of noise in a PCM system?				
(d)	With a neat diagram explain the principle and operation of Delta				
	modulation. $(5+3+2+5)$				
(a)	Explain Gram-Schmidt proces.				
(b)	Explain maximum likelihood decoding.				
(c)	Explain the difference between TDM and TDM system. $(5 + 5 + 5)$				
(a)	A message signal of $8\cos(8\pi \times 10^3 t)$ is given to 10 bit PCM system. The				
	resulting PCM signal is transmitted through free space, by using band pa				
	modulation scheme. Find the bandwidth of transmitting signal if				
	modulation scheme is-				
	(i) ASK  BINA CHOWDHURY GENTRAL LIBRARY  (GIMT & GIPS)				
	(ii) PSK Azara, Hatkhowapara, Guwahati -781017				
	(iii) FSK with $F_H = 2MHz$ and $F_L = 1 MHz$				
(b)	Explain ASK transmitter and receiver.				
(c)	What are the drawbacks of DPSK? $(5 + 6 + 4 = 15)$				
(a)	Explain ISI.				
(b)	Explain raised Cosine pulses				
(c)	Find the probability of error of matched filter. Find the capacity of a				

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Gaussian channel.

5.

3.

(5+5+5=15)

- 6. (a) Explain AWGN.
  - (b) Explain Discrete memoryless channel (DMS). Why it's called discrete memoryless?
  - (c) A discrete source emits one of five symbols once every millisecond with probabilities  $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{1}{8}$ ,  $\frac{1}{16}$  and  $\frac{1}{16}$  respectively. Determine the source entropy and information rate. (5+5+5=15)
- 7. Short notes on:
  - (a) Linear Block codes.
  - (b) Convolutional codes.
  - (c) Viterbi Algorithm.

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(5+5+5=15)

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