

- (iv) The Nyquist sampling rate for the signal $s(t) = \frac{\sin(500\pi t)}{\pi t} \times \frac{\sin(700\pi t)}{\pi t}$ is given 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 ratio $\text{SNR} \gg 1$ and bandwidth B has capacity C_1 . If the SNR is doubled keeping 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) The amplitude of a random signal is uniformly distributed between -5 V and 5 V. If the signal to quantization noise ratio required in uniformly quantizing the signal is 43.5 dB, the step of the quantization is approximately
- (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 probability P . The entropy of the source as a function of n
- (a) increases as $\log n$
(b) decreases as $\log(1/n)$
(c) increases as n
(d) increases as $n \log n$
- (viii) Noise with double-sided power spectral density on K over all frequencies is passed through a RC low pass filter with 3 dB cut-off frequency of f_c . The noise power at the filter output is
- (a) K (b) Kf_c
(c) $k\pi f_c$ (d) ∞
- (ix) Consider a Binary Symmetric Channel (BSC) with probability of error being p . To transmit a bit, say 1 , we transmit a sequence of three 1 s. The receiver will interpret the received sequence to represent 1 if at least two bits are 1 . The probability that the transmitted bit will be received in error is
- (a) $p^3 + 3p^2(1-p)$ (b) p^3
(c) $(1-p^3)$ (d) $p^3 + p^2(1-p)$

BINA CHOWDHURY CENTRAL LIBRARY
(GIT & GIPS)
Azara, Hatkhowapara,
Guwahati - 781017

- (x) Four messages band limited to $W, W, 2W$ and $3W$ respectively are to be multiplexed using Time Division Multiplexing (TDM). The minimum bandwidth required for transmission of this TDM signal is
- (a) W (b) $3W$
(c) $6W$ (d) $7W$
2. (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)
3. (a) Explain Gram-Schmidt proces.
(b) Explain maximum likelihood decoding.
(c) Explain the difference between TDM and TDM system. (5 + 5 + 5)
4. (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 pass modulation scheme. Find the bandwidth of transmitting signal if modulation scheme is -
(i) ASK
(ii) PSK
(iii) FSK with $F_H = 2\text{MHz}$ and $F_L = 1\text{MHz}$
(b) Explain ASK transmitter and receiver.
(c) What are the drawbacks of DPSK? (5 + 6 + 4 = 15)
5. (a) Explain ISI.
(b) Explain raised Cosine pulses
(c) Find the probability of error of matched filter. Find the capacity of a Gaussian channel. (5 + 5 + 5 = 15)

BINA CHOWDHURY CENTRAL LIBRARY
(GIMT & GIPS)
Azara, Hatkhowapara,
Guwahati - 781017

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 : (5 + 5 + 5 = 15)
- (a) Linear Block codes.
- (b) Convolutional codes.
- (c) Viterbi Algorithm.

BINA CHOWDHURY CENTRAL LIBRARY
(GIMT & GIPS)
Azara, Hatkhowapara,
Guwahati - 781017