Unit 10 - Week 8

Assignment 8

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-03-25, 23:59 IST.

1) Consider a baseband pulse amplitude modulation scheme with M_1 symbols which achieves the same signal to noise ratio ($\frac{E_b}{N_0}$) as that of a passband quadrature amplitude modulation scheme with M_2 symbols. If both schemes operate at the Shannon's upper limit, then the ratio M_1:M_2 is *1 point*

- $\sqrt{1+\eta}$
- $1+\eta$
- $1/\sqrt{1+\eta}$
- $1/(1+\eta)$

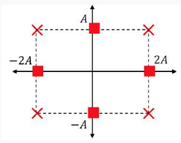
No, the answer is incorrect.
Score: 0
Accepted Answers:
$1/\sqrt{1+\eta}$

2) If the average symbol energy of a 16-QAM modulation scheme is 10 units, then to achieve the same error performance (at a very high SNR), the average symbol energies of 8-PAM and QPSK, respectively, should be *1 point*

- 21 units and $16/\pi^2$ units
- 20 units and $4/\pi^2$ units
- 20 units and 21 units
- 21 units and 2 units

No, the answer is incorrect.
Score: 0
Accepted Answers:
21 units and 2 units

3) An octal QAM signal constellation has two types of symbols as shown below. Symbols of the same type have equal probabilities but the square symbols are thrice as equiprobable as the cross symbols. *1 point*



What is the average symbol energy of this constellation?

- $3.125A^2$
- $2.125A^2$
- $1.125A^2$
- $0.125A^2$

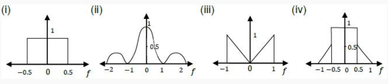
No, the answer is incorrect.
Score: 0
Accepted Answers:
$3.125A^2$

4) A 16-PAM baseband scheme operating at a data rate of R_1 provides a certain number of real dimensions over a time duration of T_1. If a 256-QAM baseband scheme operating at a data rate of $2R_1$ provides the same number of real dimensions over a time duration of T_2 then *1 point*

- $2T_1 = T_2$
- $T_1 = 4T_2$
- $T_1 = 2T_2$
- $4T_1 = T_2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$T_1 = 2T_2$

5) Which of the following represent the spectrum of a valid Nyquist pulse for sampling time T = 1? *1 point*



- (i), (ii)
- (iii), (iv)
- (i), (iii)
- (ii), (iv)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(i), (iii)

6) Which of the following statement(s) is/are always true? *2 points*

(i) There is no inter symbol interference (ISI) for $h(t) = \delta(t)$, where $h(t)$ is the channel response of a communication system while pulses are band limited pulses.
(ii) The reason for ISI is the transmission of pulses over a practical bandlimited communication channel.
(iii) ISI can be removed by using raised cosine pulses at the transmitter together with a channel equalizer at the receiver.
(iv) ISI can be removed by using root-raised-cosine pulses at the transmitter together with a channel equalizer and the matched filter (matched to the pulse shape) at the receiver.

- (iv) only
- (ii), (iv)
- (i), (ii), (iv)
- (ii), (iii), (iv)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(ii), (iii), (iv)

GROUP-A

A message signal $3\sin(2\pi\times10^3 t)$ is transmitted through a channel using a digital communication system. Sampling rate of the signal is 100 % higher than the Nyquist sampling rate and is quantized using a 256-level quantizer.

7) What is the bandwidth of the resultant baseband waveform when roll-off factor is 0.5? *1 point*

- 12 kHz
- 24 kHz
- 48 kHz
- 64 kHz

No, the answer is incorrect.
Score: 0
Accepted Answers:
24 kHz

8) What is the bandwidth if passband 16-PAM and a roll-off factor of 1 is used? *1 point*

- 16 kHz
- 32 kHz
- 64 kHz
- 128 kHz

No, the answer is incorrect.
Score: 0
Accepted Answers:
16 kHz

GROUP-B

Consider a baseband octal modulation scheme having symbols $\{s_i\}$. On the constellation diagram, these symbols are located collinearly in the increasing order of their indices i = 1,2,....7,8 such that s_0 is closest to the origin at a distance of $d = 2\sigma$ and s_8 is the farthest, where σ^2 is the noise variance of the additive white Gaussian noise channel. The symbols are equi-spaced and the distance between consecutive symbols is also d. If P_i denotes the probability of s_i then it is given that P_1:P_2:P_3:P_4 = 1:2:3:4 and $P_1 = P_{8-i}$.

9) Determine the value of signal to noise ratio in dB. *2 points*

- 94
- 47
- 19.73
- 16.72

No, the answer is incorrect.
Score: 0
Accepted Answers:
19.73

10) Determine the value of E_b/N_0 in dB. *1 point*

- 15.67
- 11.95
- 8.94
- 7.83

No, the answer is incorrect.
Score: 0
Accepted Answers:
11.95

11) If $d = 10^{-4}\sqrt{\text{W/Hz}}$ and the total noise waveform power is 5 mW, then how much is the signal bandwidth? *1 point*

- 1 MHz
- 2 MHz
- 5 MHz
- 10 MHz

No, the answer is incorrect.
Score: 0
Accepted Answers:
1 MHz

Group – C

Two users transmit simultaneously to a single base station in a cellular communication system which provides a bandwidth of 5 MHz to each user. The power received at the base station for the two users is 1 mW and 500 μW and the noise power at the receiver is 100 μW. Assume that the channel between the users and base station is AWGN.

12) Calculate the total system capacity if inter-user interference is completely mitigated. *1 point*

- 28.22 Mb/s
- 30.22 Mb/s
- 32.22 Mb/s
- 38.22 Mb/s

No, the answer is incorrect.
Score: 0
Accepted Answers:
30.22 Mb/s

13) Calculate the total system capacity if 10 % power of each user interferes with the other due to imperfect mitigation of inter-user interference. Assume that the interfering power has the same statistics as the additive white Gaussian noise. *1 point*

- 11.73 Mb/s
- 15.73 Mb/s
- 20.73 Mb/s
- 23.73 Mb/s

No, the answer is incorrect.
Score: 0
Accepted Answers:
23.73 Mb/s