

ITS 323 – QUIZ 2 ANSWERS

First name: _____ Last name: _____

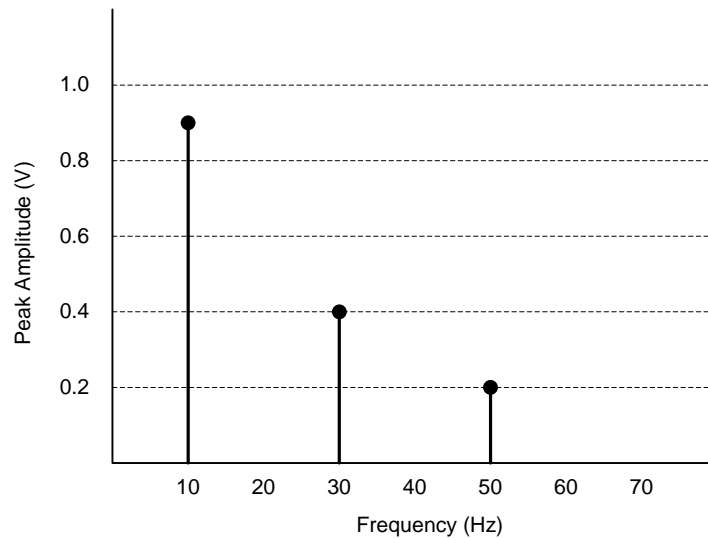
ID: _____

Total Marks: _____

out of 10

Question 1 [3 marks]

Below is a frequency domain plot of a communications signal $s(t)$.



a) What is the bandwidth of the signal $s(t)$? ($\frac{1}{2}$ mark) _____

b) What is the frequency of the signal $s(t)$? ($\frac{1}{2}$ mark) _____

c) Write a time domain equation for the signal $s(t)$? (1 mark)

$s(t) =$ _____

d) If using signal $s(t)$, two bits of information can be sent in one period, what is the maximum data rate? (1 mark)

Answers:

a. 40Hz

b. 10Hz

c. $s(t) = 0.9 \sin(2\pi t \times 10) + 0.4 \sin(2\pi t \times 30) + 0.2 \sin(2\pi t \times 50)$

d. T (period) = 0.1sec, therefore data rate = 20 bits per second

Question 2 [1 mark]

Consider a communications link with a bandwidth of 1MHz. If the received noise power is 10mW, what signal power would be required to be able to transmit at the maximum theoretical data rate of 3Mb/s?

Answer

Using Shannon's theorem we know: $C = B \log (1 + \text{SNR})$

Hence, $3\text{Mb/s} = 1\text{MHz} \log (1 + S/10\text{mw})$, therefore $S = 70\text{mW}$.

Question 3 [2 marks]

Assume you are using the free space loss equation to design a wireless link from one building to another (separated by 1km). The wireless receiver has a fixed receiver power threshold.

$$\frac{P_t}{P_r} = \frac{(4\pi d)^2}{G_t G_r \lambda^2} \text{ where } G = \frac{4\pi A}{\lambda^2}$$

After initial testing, although you have line-of-sight, you determine the received signal is too weak to communicate between buildings. List two approaches you can use to improve your design to a stronger link between buildings.

Answer

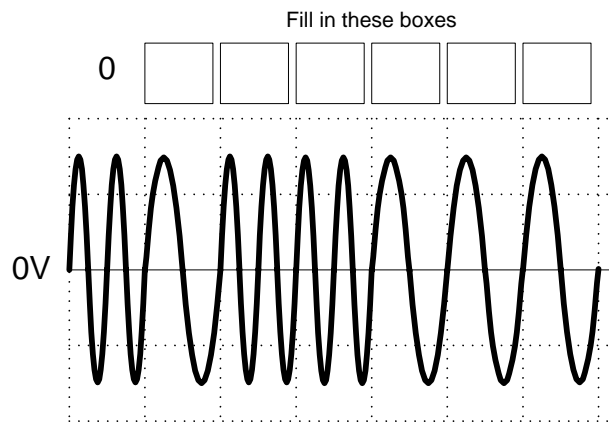
Increase the transmit power.

Increase the antenna gains, by increasing the size of the antennas.

Decrease the wavelength of the signal, by using a higher frequency transmission system.

Question 4 [1.5 marks]

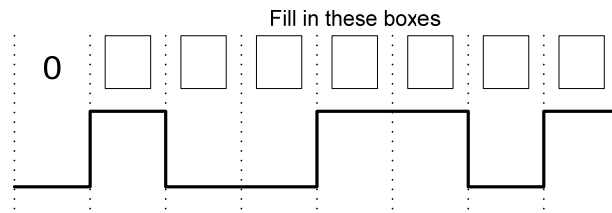
The following diagram shows part of a signal which modulates data using Binary Frequency Shift Keying. The vertical dashed lines show the transitions between each bit. Complete the boxes to show the data transmitted.



Answer: 100111

Question 5 [1.5 marks]

If the Non-Return-to-Zero Invert on ones (NRZI) encoding scheme is used, complete the bit pattern that the following signal represents. (That is, fill in the boxes).



Answer: 1101011

Question 6 [1 mark]

- a) What is the bit rate for a signal in which 10 bits take a total of 20 μ s to transmit?

Answer: _____

- b) True or false: Shielded Twister Pair provides higher data rates (than UTP) by protecting the signals from interference. True / False

Answers:

a. 500kb/s

b. True.