

ITS 323 – QUIZ 2 ANSWERS

First name: _____ Last name: _____

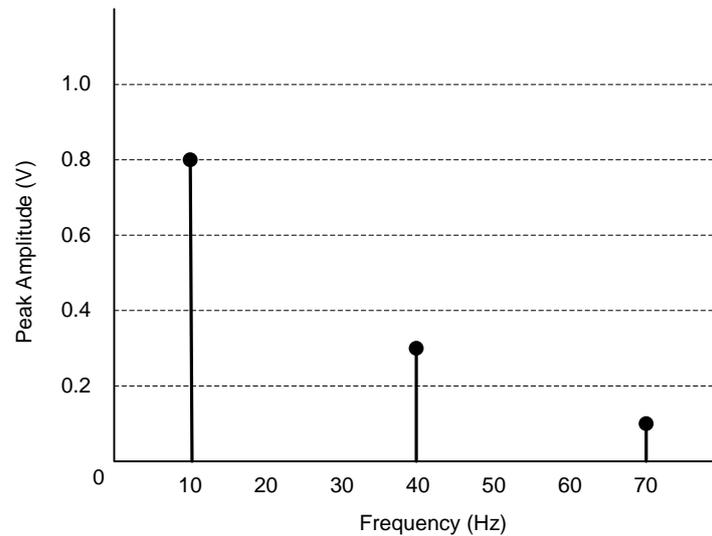
ID: _____

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. 60Hz

b. 10Hz

c. $s(t) = 0.8 \sin(2\pi t \times 10) + 0.3 \sin(2\pi t \times 40) + 0.1 \sin(2\pi t \times 70)$

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

Question 2 [1 mark]

Consider a communications link with a signal-to-noise ratio of 63. What bandwidth would be required 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, $3\text{Mb/s} = B \log (1 + 63)$, therefore $B = 500\text{kHz}$.

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

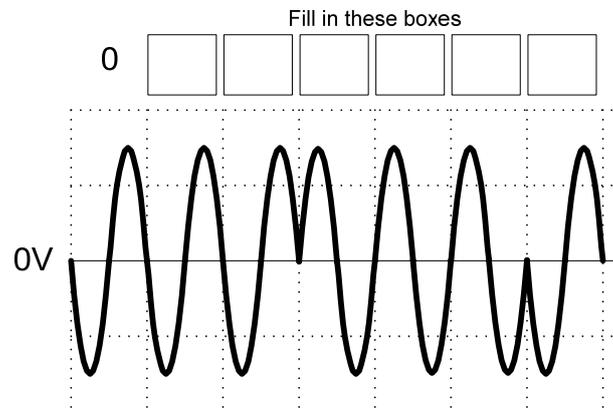
Increase the transmit power.

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]

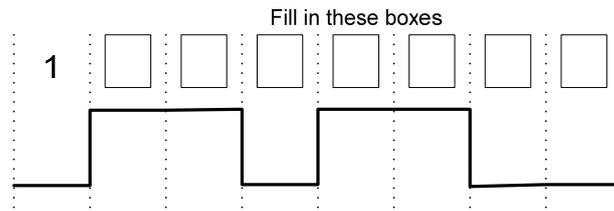
The following diagram shows part of a signal which modulates data using Binary Phase Shift Keying. The vertical dashed lines show the transitions between each bit. Complete the boxes to show the data transmitted.



Answer: 001110

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:** 1011010

Question 6 [1 mark]

- a) What signalling rate is needed to send data at 1Mb/s if two signal elements represent 1 data bit?

Answer: _____

- b) True or false: Although optical fibre provides much higher data rates than copper twisted pairs, the distance that can be transmitted of a single optical fibre length is shorter than copper twisted pair. True / False

Answer:

a. 2M signals per second

b. False. Optical fibre provides higher data rates than twisted pair, and can be used over larger distances.