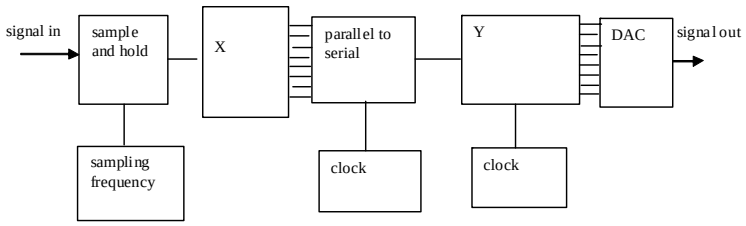
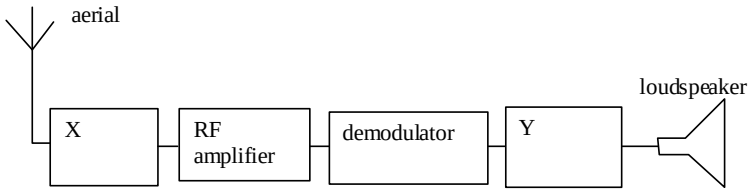
Extension Worksheet – Option F, Worksheet 3

1 The diagram shows blocks used in a digital transmission.



Name the blocks labelled X and Y and state their function. [4]

2 The diagram shows blocks used in a radio receiver circuit.



Name the blocks labelled X and Y and state their function. [4]

3 A digital signal is sampled at a frequency of 2.0 kHz and each sample consists of 8 bits. Calculate:

a the bit rate for the signal. [1]

b the duration of one bit. [1]

4 State the effects of material and modal dispersion on a signal propagating in an optical fibre. [2]

5 State one source of attenuation in an optical fibre. [1]

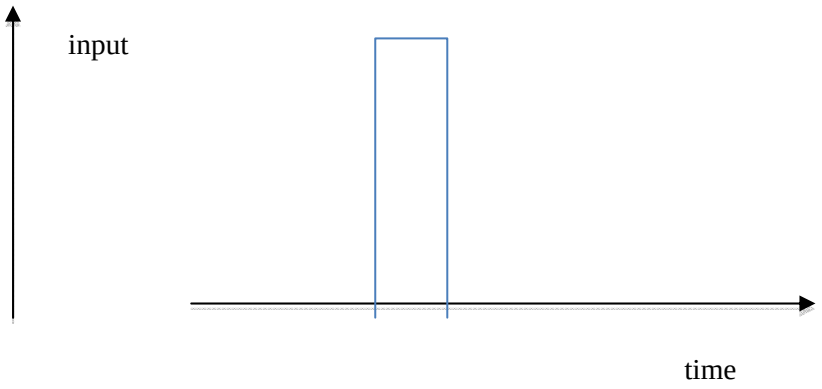
6 The attenuation per unit length for an optical fibre is 3.0 dB km^{-1}. Calculate the ratio $\frac{P_{out}}{P_{in}}$ after the signal has travelled 5.0 km in the optical fibre. [3]

7 The electromagnetic radiation used in an optic fibre is infrared radiation. Suggest why infrared radiation is used. [2]

8 An amplifier has a gain of 8.0 dB. The signal that is input to the amplifier has power 0.30 mW. Calculate the power of the output signal. [2]

9 State two advantages of coaxial cables over wire pairs. [2]

10 The diagram shows a pulse that is input to a coaxial cable.



a On the axes below draw the shape of the pulse after it has travelled a large distance in the cable.

output

[2]

b Explain the shape you have drawn in **a**. [2]

c State and explain the feature in the graph in **a** that shows that there is a limit on the frequency of the pulses that can be transmitted along the cable. [2]

11 A ground-based station emits radiation of power 30 kW and frequency 15 GHz. It may be assumed that the radiation is emitted in every direction. Some of this radiation is received by a satellite in orbit. The intensity of the radiation at the position of the satellite is 2.6×10^{-8} W m^{-2}.

a Calculate the power received by the satellite. [3]

b Estimate the height of the satellite above the Earth's surface. [2]

c The signal at the satellite is collected by an area of 2.5 m^2. Calculate the power loss of the signal in decibels. [2]

d Suggest why, in practice, the power loss is less than your answer to **c**. [1]

e The signal is amplified by the satellite and is returned to Earth. Suggest why the frequency of the return signal must be different from 15 GHz. [2]