Name:	ID:	Section:

1. A non-periodic composite signal has a bandwidth of 20 kHz and a maximum frequency of 50 kHz. The signal has peak amplitudes of 5 V at both the lowest and highest frequencies and a peak amplitude of 12 V at 35 kHz. The amplitude changes smoothly from the minimum frequency to the maximum frequency and then decreases smoothly back to the maximum frequency.
a) Calculate the minimum frequency of the signal.   [2]
b) Draw a frequency domain plot.   [2]

2. You need to send a PDF document containing 20 pages to a colleague over a 15 Mbps optical fiber link. Each page has an average of 40 lines with 90 characters per line. The distance between you and your colleague is 5000 km, and the signal propagates through the optical fiber at 200,000 km/s. The transmission path includes four routers, each with an average processing delay of 3 ms and a queuing delay of 5 ms per router. Calculate the total delay for the communication.   [4]

3. Consider a channel with a bandwidth of 5 MHz. The signal strength is 100 times stronger than the noise level in the channel.

i) What is the highest data rate achievable by this channel? [2 marks]   [2]

ii) In practice, better error performance can be achieved by using a lower data rate. Assume a data rate is chosen to be 60% of the highest data rate. How many signal levels are needed to achieve this lower data rate?   [2]

4. A transmission line is 5 km long, and along this line, the signal weakens by 1 W/km before reaching the destination. The initial signal strength at the source is 10 W.

Calculate the attenuation in decibels (dB) by the time the signal reaches the destination.   [2]

5. How can transmission impairment occur? Mention one reason.   [1]