

Problem 6.12

We are given the following specifications:

$$B_T = 3 \text{ kHz}$$

$$\frac{1}{T_b} = 4.5 \text{ kilobits/s}$$

(a) The transmission bandwidth is related to the roll-off factor by the formula (see Eq. (6.21))

$$B_T = B_0(1 + \alpha) \tag{1}$$

where

$$B_0 = 1/(2T_b)$$

Therefore, with $(1/T_b) = 4.5$ kilobits/s, we have

$$B_0 = 2.25 \text{ kHz}$$

Hence, solving Eq. (1) for the roll-off factor, we get

$$\begin{aligned} \alpha &= \frac{B_T}{B_0} - 1 \\ &= \frac{3}{2.25} - 1 \\ &= \frac{1}{3} \end{aligned}$$

(b) The excess bandwidth is defined (see Eq. (6.22))

$$\begin{aligned} f_v &= \alpha B_0 \\ &= \frac{1}{3} \times 2.25 \\ &= 0.75 \text{ kHz} \end{aligned}$$