(4f) As shown in this figure, a WLAN signal arrives at a ground floor access point from a laptop (Pt=100 mW) on the 3rd floor, via scattering from a tree outside of the building. Neglecting wall/window losses, and assuming $\sigma_{RCS}$ is 4 m$^2$ and antenna gains of 3 dBi, what is the received power from the scatter path?

**Solution:** The path lengths from the TX to the tree, and from the tree to the RS, are both $d_1 = d_2 = \sqrt{10^2 + 5^2} = 11.2$ meters. An RCS of 4 m$^2$ is equal to 6 dB meters$^2$. For WLAN, $f_c$ is about 2.4 GHz, so $20 \log_{10} \lambda = -18.1$. Note that the term is $20 \log_{10} \lambda$, not $20 \log_{10} \lambda^2$ as it originally stated in my notes. Using the bistatic radar equation,

$$P_r \text{(dBm)} = P_t \text{(dBm)} + G_t \text{(dB)} + G_r \text{(dB)} + \sigma_{RCS} \text{(dB meters}$^2$) + 20 \log_{10} \lambda - 30 \log_{10} 4\pi - 20 \log_{10} d_t - 20 \log_{10} d_r$$

$$= 20 \text{(dBm)} + 3 + 3 + 6 - 18.1 - 33.0 - 21.0 - 21.0$$

$$= -61.1 \text{(dBm)}$$