## Assignment 4

1) A TV station transmit video with a rate of 12 Mbps. Assume that the station wishes to have error free transmission for half an hour.
   a. What is the required BER?
   b. Assume that the station has 6 MHz. of bandwidth and uses an MPSK modulation scheme with a roll-off factor of 0.2. What is the required $\frac{E_b}{N_0}$ ?
   c. What would be the required $\frac{E_b}{N_0}$ if the DVB Reed Solomon code is used?
   d. Assume that the carrier frequency is 521 MHz. and the station would like to cover viewers having antennas with 5 dBi gain and receivers with overall noise figure of 15 dB up to a distance of 50 Km. What should be the station's EIRP without and with RS coding? (Assume LOS propagation model)
   e. Repeat part (d) if a convolutional code with coding gain of 4 dB is used as the inner code and the RS code as the outer code.
   f. Repeat part d and e considering two-ray propagation model. Assume that $h_t = 50$ m. and $h_r = 10$ m.

2) The uplink signal to noise ratio of a satellite link is $\left(\frac{E_b}{N_0}\right)_U = 12$ dB and the downlink SNR is $\left(\frac{E_b}{N_0}\right)_D = 20$ dB. Find the overall $\frac{E_b}{N_0}$ in dB.

3) A TV receiver has an antenna with noise temperature of $2900°$ K, an LNA with a gain of 20 dB and noise figure of 6 dB, a cable with 3 dB loss, an amplifier with gain of 30 dB and noise figure of 15 dB and a receiver with a noise temperature of $900°$ K. Find the overall noise figure of the system:
   a. If the LNA is connected between the antenna and cable.
   b. If the LNA is connected at the end of the cable.