

1. We measure the performance of a telephone line (4KHz of bandwidth). When the signal is 10V, the noise is 5mV. What is the maximum data rate supported by this telephone line? (20%)
2. Calculate the bit rate for the given baud rate and type of modulation.
  - a. 1000 baud, FSK (5%)
  - b. 1000 baud, ASK (5%)
  - c. 1000 baud, 8-PSK (5%)
  - d. 1000 baud, 16-QAM (5%)
3. Let  $g(t) = A \cdot \text{rect}(t/T)$ . Find and sketch its Fourier transform function  $G(f)$ . (20%)
4. Describe the principle of spread spectrum communications in detail. (20%)
5. Consider a  $75\Omega$  resistor maintained at room temperature of 290K. Assuming a bandwidth of 1MHz, calculate the following:
  - a. The root-mean-square value of the voltage appearing across the terminals of this resistor due to thermal noise. (10%)
  - b. The maximum available noise power delivered to a matched load. (10%)note: Boltzmann's constant  $k=1.38 \times 10^{-23}$