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Notes and books are closed. Exam duration is 75 min. Good Luck.

- 1) Determine the height of an antenna for a TV station that must be able to reach customers up to 80 km away.
- 2) A microwave transmitter has an output of 0.1W at 2GHz. Assume that this transmitter is used in a microwave communications system where the transmitting and receiving antennas are parabolas, each 1.2 m in diameter. What is the gain of each antenna in decibels?
- 3) A researcher wishes to digitally record analog sounds for testing animal hearing with frequencies of up to 100 kHz.
 - a. What is the minimum sampling rate required to process these sounds?
 - b. By using 16-bit samples, what is the data rate of the resulting digital signal?
- 4) Draw the block diagrams of error detection process for both on transmitter and receiver sides. Write down the definitions of all abbreviations used.
- 5) If the generator polynomial used for CRC is $x^3 + 1$ and the message is 10110101, what is the actual frame transmitted?
- 6) Consider an MFSK scheme with carrier frequency $f_c = 250$ kHz, difference frequency $f_d = 25$ kHz, and $L = 3$. Calculate the frequency assignments for all related possible data combinations.
- 7) Encode the bit-pattern 1010000101 using the following digital encoding schemes. Assume that previous state of signal and/or polarity of the last pulse are negative.
 - a. NRZ-I
 - b. Bipolar-AMI
 - c. Manchester
- 8) Represent the bit sequence 10111011 using ASK, BFSK and BPSK encoding schemes the same vertical axis while drawing.
- 9) Briefly explain what automatic repeat request (ARQ) is. List and briefly define versions of ARQ.
- 10) a. What is the main reason for using scrambling techniques? Write down the two common techniques and briefly explain them.
b. Define upstream and downstream with respect to subscriber lines.