ELEX 3525 :Data Communications
Term 201330

MID-TERM EXAMINATION

10:30 – 12:20 AM
October 30, 2013

This exam has four (4) questions. The marks for each question are as indicated. There are a total of 16 marks. Answer all questions. Write your answers in the exam book provided. Show your work. Numerical answers must include units. You may answer the questions in any order. Books, notes and calculators are allowed. You may keep this exam paper.

Show your work.

Question 1 (5 marks)

Sketch the RS-232 signal used to transmit the character 'X' ("capital ex") assuming a bit rate of 4800 bps, 7 bits per character and no parity. Show the complete waveform between line-idle conditions. Show the bit duration on the sketch.

The difference between the positive and negative voltages is the minimum allowed by the RS-232 standard. Show the voltage levels on the sketch.

Question 2 (3 marks)

A 150 MHz signal is fed through a 40 cm length of co-ax cable. The cable causes an apparent phase shift of 45 degrees. What is the delay? The velocity factor of the cable? The relative dielectric constant of the dielectric?

Question 3 (4 marks)

A typical phone line has an SNR of 45 dB and a bandwidth of 4 kHz.

Your manager asks you to buy a phone line modem that operates at 80 kb/s but you can only find ones that go up to 56 kb/s.

Why is this? Provide a quantitative (numerical) explanation based on theory covered in this course.

Question 4 (4 marks)

A communication system uses a bipolar NRZ signalling over 50 ohm co-ax cable with voltages of ± 5 V. The channel adds (zero-mean) Gaussian noise to the signal. The received signal to noise power ratio is measured to be 6 dB. What are the signal and noise powers in mW?

Consider the case where +5 V is transmitted. What is the probability that the sum of the signal plus noise is negative? You may use the approximation formula in Assignment 3.