This exam paper is for:

Each exam is equally difficult.
Answer your own exam.

Do not start until you are told to do so.

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ELEX 4340 : Data Communications
Term 201430

FINAL EXAMINATION
8:00 – 11:00 AM
January 7, 2015

This exam has 7 (seven) questions on 2 (two) pages. The marks for each question are as indicated. There are a total of 29 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 and notes are allowed. No electronic devices other than calculators are allowed. You may keep this exam paper. Show your work.

Question 1 (3 marks)

The Greek Small Letter Xi (ξ) has a Unicode code point of U+03BE (hex 0x03be). How many octets (bytes) are required for the UTF-8 encoding? What are the values of those bytes in hex?

Question 2 (4 marks)

Draw the RS-232 waveform that would be used to transmit the octet value 0x53 assuming 7 data bits, one stop bit and odd parity. Label the voltage axis assuming voltage levels of ± 8V. Show the bit period assuming a bit rate of 9.6 kb/s.

Question 3 (4 marks)

An FM radio station transmits a signal with a power of 50 kW at a frequency of 100 MHz. Assuming free-space propagation and that the transmitter and receiver antenna gains are both 0 dB, how much power (in kW) is received at a distance of 15 km? What is the received power in units of dBm?

Question 4 (3 marks)

The following diagram shows the overall transfer function of a channel, including transmitter and receiver filtering. What is the -6 dB bandwidth? What is the excess bandwidth parameter (α)? What is the maximum symbol rate that could be transmitted over this channel without ISI?
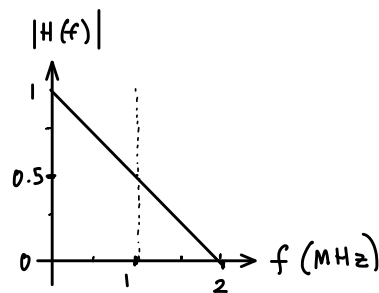
Question 5 (3 marks)

What would be transmitted after HDLC framing of the bit sequence: 1111 1100? Include flags and any bit stuffing required.

Question 6 (3 marks)

You measure a Gaussian noise signal and find the RMS voltage of the noise measured with AC coupling is 1 V and the average voltage of the noise measured with DC coupling is +1 V. What fraction of the time will this signal exceed a voltage of +3 V?

Question 7 (9 marks)

(a) A code has 16 valid codewords. How many bits are transmitted per codeword? If each codeword consists of 7 bits, what is the code rate?

(b) A satellite communication system has a long delay and a high frame error rate. For a particular application high throughput is more important than low implementation costs. Which of the three ARQ techniques studied in the course would be most appropriate?

(c) If a code has a minimum distance of 4, how many errors can be detected? How many errors can be corrected?

(d) Which Ethernet standard(s) that we have studied use a Manchester line code?

(e) Multiple users need to share a communication channel. Which multiple-access technique(s) would be appropriate if they were sending constant bit rate (CBR) data? If they were sending bursty data?

(f) What is the netmask for the network 192.168.128.0/17?