



MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2012/2013

SECOND YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE (MAIN CAMPUS)

CCS 212: DATA COMMUNICATIONS

Date: 22nd July, 2013

Time: 2.30 – 4.30 p.m.

INSTRUCTIONS:

- ◆ Attempt Question ONE (COMPULSORY) and any other TWO questions from the Five Questions set.

QUESTION ONE (30 MARKS)

- a) A Data Communications System comprises an audio input device at the source and an audio output device at the destination. The destination is several hundred kilometers from the source and the channel is predominantly analogue.
- i) Draw the detailed model of this system and explain the functions of the components of the model. [5 mks]
 - ii) Indicate the signals that propagate through the system, explaining how the signals get modified between the source and the destination. [4 mks]
 - iii) Explain the model in terms of the OSI layers, giving an example of a protocol or standard for each function. [5 mks]
- b) What factors determine the rate at which data signals can propagate through the communications system? [2 mks]
A data transmission system has a bit rate of 256 Kbps, when using four signal levels. What is the Baud rate for the system? [2 mks]
- c) Explain the need for the use of standard frame formats for data in a data communications system. [2 mks]
A High Definition TV (HDTV) has a resolution of 1920 x 1080 pixels, true colour and refresh rate of 50 frames per second. Determine the speed of the channel required in order to transmit the signals in real time. [4 mks]
- d) What is the required bandwidth of a low-pass channel if we need to send 1 Mbps by using baseband transmission, assuming up to 5th odd harmonics are present? [4 mks]
- e) In the transmission of a byte ($b_7b_6b_5b_4b_3b_2b_1b_0$), bits b_1 , b_4 and b_6 are found to be in error. What is the burst error length? [2 mks]

QUESTION TWO (20 Marks)

- a) Explain the characteristics, merits and demerits of guided and unguided media in data communication systems. [6 mks]
- b) A digital signal propagating through a communications channel often experiences a number of impairments. Explain, with aid of sketches, the effects of three major impairments. [6 mks]
- c) A data communications system comprises three major components between the transmitter and the receiver: a channel, an amplifier, and a channel, with respective gains of -3dB, +12 dB, and -4 dB. If the signal from the transmitter into the channel is 20 dBm, determine the signal at the input of the receiver in watts. [8 mks]

QUESTION THREE (20 Marks)

- a) State and explain the desirable characteristics of line encoding schemes used in data communication systems. [4 mks]
- b) In a digital transmission system, the receiver clock is 0.1 percent slower than the sender clock. How many fewer bits per second does the receiver receive if the data rate is 1 Mbps? [4 mks]
- c) A system is using NRZ-I to transfer 1-Mbps data. Determine the baud rate of the system? [3 mks]
- d) Draw the waveforms for NRZ-L, NRZ-I, Manchester, Differential Manchester, AMI and Pseudo-Ternary line encoding schemes for the bit stream 011000111010. [9 mks]

QUESTION FOUR (20 Marks)

- a) Explain, with the aid of sketches, the differences between bit-oriented and character-oriented synchronous transmission protocols. Give one practical example of each. [6 mks]
- i) What is byte stuffing and why is it necessary? [2 mks]
- ii) An ASCII control character 'STX' appears among the characters sent from a source to a destination. Illustrate and explain how byte stuffing and unstuffing can be used to avoid any confusion in the interpretation of the data at the receiver. [6 mks]
- b) Characters *Hello* are transmitted using the RS-232C between a computer and a Modem. Odd parity is added to each character at the MSB position. Draw the transmitted signal, assuming an NRZ scheme. [6 mks]

QUESTION FIVE (20 Marks)

- a) Explain, with the aid of a sketch, the principle of error detection and control in a data communications system. Hence [3 mks]
- i) Distinguish between simple parity and block parity schemes. [2 mks]
- ii) Hamming Distance and Cyclic Redundancy Check schemes. [2 mks]
- b) An error control scheme is based on CRC polynomial divisor of 1101 and is used to transmit data bits 1011 between the source and the destination. The system uses a seven bit codeword.
- i) Determine the transmitted codeword. [5 mks]
- ii) If there is no transmission error, perform the CRC at the destination and show how the receiver will detect this condition. [3 mks]
- iii) If the transmitted data changed to 1111, perform the receiver CRC to verify this new condition. [5 mks]