

UNIVERSITY OF OSLO

Faculty of Mathematics and Natural Sciences

Exam in : FYS 3240/4240
Day of exam: : 8. June 2012
Exam hours: : 09.00 – 12.00
This examination paper consists of 2 pages.

Permitted materials: : **Calculator**

Make sure that your copy of this examination paper is complete before answering.

Problem 1

- a) What is an interrupt? Explain.
- b) Explain why DMA is usually used instead of interrupt in data acquisition systems?
- c) Explain signal-based and time-based synchronization.
- d) Explain how a multi-core processor (CPU) can be used to increase the performance of a data acquisition system.
- e) What is the smallest detectable change in the input signal in a data acquisition system having a 16-bits analog-to-digital converter (ADC) and a dynamic range from -5 V to +5 V?
- f) Given that you have to measure 100 analog channels with a sample frequency of 200 kHz on each channel, and the data are to be stored on a disk with 64 bits per sample (double precision floating point). What is the generated bandwidth? Give the answer in number of MB/second (MB = Mega Byte)?

Problem 2

- a) In serial communication using RS-232 a special convention with start bit and stop bit etc. is used. Explain.
- b) List 4 common computer buses used for data acquisition, and explain some of their properties and differences.

Problem 3

- a) Write a program (the function main) in C-code for the XMEGA microcontroller that does the following:

The program should continuously write an 8-bit value to PORT B on the microcontroller. This 8-bit value should start at 127 (decimal value) and count down (decrement) with one for each iteration. When the value reaches 0 it should start counting down again from 127.