University of Toronto  
Department of Electrical and Computer Engineering  
ECE411H1S – Real-Time Computer Control

Information Sheet

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**Lectures:**  
Monday, 4-5, GB220  
Wednesday, 4-5, GB220  
Friday, 4-5, GB220

**Course Outline**

1. Discrete-time linear systems: solution of difference equations, analysis using z-transforms, state models and their analysis, state space realization of transfer functions.

2. Sampled-data systems: sample and hold operations, continuous-time state equations and their discretizations; transform analysis and discretization of continuous-time transfer functions; effects of sampling on frequency response, aliasing.

3. Control design using state space methods: controllability and stabilization by state feedback, observability and state estimation using full-order observers, output feedback; tracking and regulation, exomodels, internal models.

4. Control design by discretization of continuous-time controllers: the bilinear transformation and its properties, discretization errors, pole-zero matching.

5. Introduction to real-time scheduling: priority scheduling, deadlines, schedulability of periodic processes; rate monotonic scheduling and rate monotonic bound for schedulability, earliest deadline first scheduling; timing diagrams. TrueTime simulation tool.

**Textbook:** There is no required textbook. Course notes will be provided on Blackboard. They are self-contained and serve as a textbook for this course. You may also consider consulting the following reference:

**Labs:** All labs are held in BA3114. There will be five labs in alternating weeks, starting January 19, 2016. Labs are performed in groups of two students. You’ll form lab groups at the beginning of the first lab. All labs require a preparation (submitted before the lab to the TA) and a report. One week after the lab, each lab group submits a lab report.

**Lab Policies:** There are no makeup labs. Your TAs will mark down attendance. You cannot switch lab sessions.

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<th>Section</th>
<th>Day and Time</th>
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<td>Friday, 12-3</td>
<td>Jan 22</td>
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<td>Feb 26</td>
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<td>PRA0102</td>
<td>Tuesday, 12-3</td>
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<td>PRA0103</td>
<td>Thursday, 9-12</td>
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<td>March 10</td>
<td>March 24</td>
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* Moved due to Good Friday

**Tutorial:** Monday 3-4, HA403, in weeks alternating to the labs, starting January 11.

**Midterm:** There will be one midterm administered on Thursday March 3, 2016, 6-8pm, MS2170.

**Grading:**

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