ENGG4420 (Real-Time Systems Design)

**Brief course outline:**

Real-time systems design (ENGG4420) is a course that teaches real-time concepts from a system and computing perspective. The material presented in this course covers to various levels of detail the following topics: system modeling, real-time data acquisition, hard and soft real-time system concepts for real-time computer control; formal real-time systems design and analysis techniques (process-based, event-based, and Petri Nets); real-time operating system (RTOS) concepts for embedded and industrial applications; real-time programming using uC/OS, MQX (or other equivalent RTOS for embedded applications) and Real-Time LabView; real-time scheduling concepts for real-time digital controllers; real-time scheduling algorithms for multiprocessor and uni-processor systems; system analysis of discrete systems using Z-transform; design and analysis of real-time digital controllers and digital control tasks; safety and reliability issues in real-time systems.

Expanded course outline with references:

**ENGG4420 -- COURSE OUTLINE**

Chapter 1: Real-Time Computer Control

* Sections: A) Real-Time Definitions and Development B) Dynamic Models; C) Feedback Control, PID, Tuning; D) Implementation of Real-Time Control Algorithms
* **References**: 1) Feedback Control of Dynamic Systems By Franklin et al.; 2) Real-Time Computer Control By Bennett; 3) ENGG4420 Lab Manual by Radu Muresan.

Chapter 2: Real-Time Operating Systems Concepts

* Sections: A) Introduction; B) Common Kernel Objects; C) uC/OSII-III and MQX Concepts and Examples; D) LabVIEW Real-Time System Development
* **References**: 1) MicroC/OS-II-III The Real-Time Kernel By Labrosse; 2) MQX By Freescale; 3) Embedded Systems By Kamal; 4) LabView 2009; LabView Real-Time Application Development Course by NI;

Chapter 3: Scheduling

* Sections: A) Uniprocessor and Multiprocessor Scheduling Algorithms; B) Real-Time Control Scheduling; C) PIP, PCP Protocols; D) Real-Time Clocks

Chapter 4: Real-Time System Modeling using Petri Nets

Chapter 5: Safety and Reliability Issues in Real-Time Systems

* **References** for Chapters 4, 5, and 6: 1) Realtime Systems By Nissanke; 2) Real-Time Systems By Krishna et al.; 3) Real-Time Systems by Rajib Mall.