CARLETON UNIVERSITY
Department of Systems and Computer Engineering

SYSC 4505 **Automatic Control Systems I** **Fall 2011**

Course Outline

Instructor:

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Course Objectives:

The objective of the course is to teach the student the fundamental concepts of control system design and analysis. The course reviews linear systems theory and presents how linear systems theory is used to both specify performance requirements and how to design the control system. A number of electromechanical examples are used to illustrate control system analysis and design.

Prerequisites:

MATH 2004 and (SYSC 3500 or 3600). Students should have prior exposure to elementary transforms and differential equations.

Textbook:

K. Ogata, "*Modern Control Engineering*, *Fifth Edition*" Prentice Hall 2010.

Labs:

Labs are three hours on alternate weeks.

Grading Scheme:

- Assignments 15%
- Labs 15%
- Midterm 10%
- Final Exam 60%

Students with Disabilities:

Students with disabilities requiring academic accommodations in this course must register with the Paul Menton Centre for Students with Disabilities for a formal evaluation of disability-related needs. Registered PMC students are required to contact the Centre, 613-520-6608, every term to ensure that I receive your Letter of Accommodation, no later than two weeks before the first assignment is due or the first in-class test/midterm requiring accommodations. If you require accommodation for your formally scheduled exam(s) in this course, please submit your request for accommodation to PMC by November 11th 2011 for Fall term (December exams).

Final Exam: *Is for evaluation purposes only and will not be returned to the student.*

Course Outline: (Approximate timing.)

Week 1 – Review of Laplace transforms, transfer functions, dynamics of linear systems and frequency response. (Appendix A and B, pp.159 – 182 & pp. 398 - 415)

Week 2 - Review of modeling of dynamic systems. (Course Notes)

Week 3 - Review of block diagram reduction and Op-Amp circuits.(Course notes & pp.78-79)

Week 4 – Steady state errors, system types, stability and Routh-Hurwitz criteria. (pp. 225-230 & pp. 212-218)

Week 5 – The effect of feedback on system dynamics. Construction of root loci. Real axis segments, asymptotic angles, centroids of asymptotes.(pp.269-308)

Week 6 – Construction of root loci continued. Root locus design examples. (pp.269-308)

Week 7 – Time domain controller design. The PD and PID controllers.(pp. 567-572)

Week 8 – Frequency response analysis. Nyquist polar plots, The Nichols chart, gain margin and phase margin. (pp. 427-450 & pp. 477-485)

Week 9 – Compensation design. Phase lead compensation in time domain and frequency domain. (pp. 311-320, 493-501)

Week 10- Phase lag compensator design in the time and frequency domain. (pp. 321-329 & pp. 502-511)

Week 11- Compensator design continued. Design of lead-lag compensation. (pp. 330-341 & pp. 511-517)

Week 12– State space techniques, matrix formulation. (pp. 648-652 & 660-667)

Week 13- Matrix techniques in control and conversion to discrete time.