POLYTECHNIC INSTITUTION

Course Outline

School of: Manufacturing, Electronics and Industrial Processes
Program: Bachelor of Technology in Manufacturing

MTEC 7054
Manufacturing Control Systems

Start Date:	September 2006				**End Date:**	December 2006			
Total Hours:	45	**Total Weeks:**	12		**Term/Level:**	Degree	**Course Credits:**	3	
Hours/Week:	3.25	**Lecture:**	**3.25**	**Lab:**	**Shop:**		**Seminar:**	**Other:**	6

Prerequisites:

Course No.	Course Name
MECH 1210	Manufacturing Processes
MECH 4450	Mechanical Control Systems

MTEC 7054 is a prerequisite for:

Course No.	Course Name
MTEC 8050	Manufacturing Automation Systems
MTEC 7051	Introduction to Machine Vision

■ Course Description

Covers control systems related to manufacturing operations. Topics include determining the system block diagram, control algorithms such as ON/OFF, three point and PID control, determining the transfer function for a system using the Laplace transform, stability of systems based on the Bode diagram, interfacing production sensors and actuators to Programmable Logic Controllers (PLCs), using analogue to digital converters and logic programming, sequence programming and networking of PLCs. Commercial simulation software will be introduced.

■ Evaluation

Assignments and Labs	20 %	Comments:
Midterm Examination	35 %	Students must achieve a 65 % or higher grade to pass this course.
Final Examination	45 %	
TOTAL	100 %	

■ Course Learning Outcomes/Competencies

Upon successful completion, the student will be able to:

- Draw the system block diagram based on a description or schematic drawing of a system.
- Explain the correlation between capacitance, resistance and inductance (potential energy, friction and kinetic energy) in different control system implementations.
- Describe how ON/OFF, three point and PID control are implemented.
- Explain the effect of changing PID process parameters on the response of a control system.
- Determine the transfer function and the response of a simple system using Laplace Transforms.
- Estimate the stability, steady state error, settling time, rise time and percent overshoot of a system in a unity feedback configuration based on the Bode plot for that system.
- Explain the issues with A/D conversion including aliasing, sampling and quantization errors and how to avoid them.
- Develop a PLC program to perform a sequence of operations on a machine.
- Describe the typical industrial control networking methods used in industry.

Verification

I verify that the content of this course outline is current.

Authoring Instructor — 29 Aug 2006 — Date

I verify that this course outline has been reviewed.

Program Head/Chief Instructor — 29. Aug. 2006 — Date

I verify that this course outline complies with BCIT policy.

Dean/Associate Dean — 2006/09/01 — Date

Note: Should changes be required to the content of this course outline, students will be given reasonable notice.

Instructor:

Taco Niet	Office Location:	SW9-205	Office Phone:	604-456-8032
	Office Hours:	As posted.	e-Mail Address:	tniet@my.bcit.ca

■ Learning Resources

Required:

Niet, Taco. MTEC 7054 Course Notes. 2006

Recommended:

■ Information for Students

Note: Please refer to BCIT policy number 5002, Student Regulations Policy, for additional information. Policies are available at http://www.bcit.ca/about/administration/policies.shtml.

Ethics: BCIT assumes that all students attending the institute will follow a high standard of ethics. Incidents of cheating or plagiarism may, therefore, result in a grade of zero for the assignment, quiz, test, exam or project for all parties involved and/or expulsion from the course.

Assignments: Assignments, lab reports or projects must be done on an individual basis unless otherwise specified by the instructor. Late assignments, lab reports or projects will be devalued 20% per calendar day late to a maximum of 3 days late.

Assignment Drop Box: The instructors drop box for assignments and labs is located under the stairs in the lobby of building SW9. Students are responsible for ensuring labs and assignments are submitted to the correct box and on time.

Makeup Tests, Exams or Quizzes: There will be **no** makeup tests, exams or quizzes. If you miss a test, exam or quiz, you will receive zero marks. Exceptions may be made for **documented** medical reasons or extenuating circumstances. In such a case, it is the responsibility of the student to inform the instructor **immediately**.

Attendance: The attendance policy as outlined in BCIT Policy 5002 will be enforced. Attendance will be taken at the beginning of each session. Students not present at that time will be recorded as absent.

Illness: If you miss an evaluation such as an assignment, quiz, exam, or project, or you miss 3 or more consecutive days of class, you must provide the department with a BCIT Student Medical Certificate (available at http://www.bcit.ca/admission/downloads.shtml). You may be asked to complete the work that you missed or the course evaluation may be adjusted to reflect the missed component(s).

Attempts: Students must successfully complete a course within a maximum of three attempts. Students with two attempts in a single course must get written permission from the Associate Dean to attempt the course for the third time. Students who have not successfully completed a course within three attempts will not be eligible to graduate from the program.

Advancement: Students who fail three or more courses in a term cannot advance to the next term and may be asked to discontinue from the program.

Course Outline Changes: The material or schedule specified in this course outline may be changed by the instructor. If changes are required, they will be announced in class.

■ Assignment Details

Details of assignments and labs will be provided in class.

Schedule

Week of/ Number	Outcome/Material Covered	Assignment or Lab
1	Course Intro Control System Basic Concepts, Cruise Control Example	A1 – Block Diagram Math
2	System Response, Control Algorithms and System Simulation	A2 – Control System Spreadsheet
3	LAB #1 – PI Control of Heating System	Lab 1 Report
4	Gain and Transfer Function, Fourier Transform, Laplace Transform	A3 – Laplace and System Response
5	The Bode Plot and System Stability, Midterm Review	Midterm Review Problems
6	MIDTERM EXAM	---
7	Hard-Wired vs. Programmable Control, Sinking vs. Sourcing	A4 – Programmable Control
8	LAB #2 – Hard Wired Control and PLC Interfacing	Lab 2 Report
9	A/D and D/A Conversion, Aliasing (DEMO of SIMULATION)	A5 – Aliasing and A/D
10	Networking and Communications, LAB #3 – PLC Sequencing	---
11	Final Review, Lab #3 Completion	Final Review Problems, Lab #3 Report
12	FINAL EXAM	---