



POLYTECHNIC INSTITUTION

School of: Manufacturing, Electronics and Industrial Processes
Program: Mechanical Engineering Technology, Plastics Technology
Option: Mechanical Design, Manufacturing, Plastics

MECH 4450
Mechanical Control Systems

Table with course details: Start Date (March 2006), End Date (May 2006), Total Hours (40), Total Weeks (10), Term/Level (4), Course Credits (2.5), Hours/Week (4), Lecture (2), Lab (2), Shop, Seminar, Other.

Prerequisites: MECH 4450 is a prerequisite for:

Table with prerequisite information: Course No. (ELEX 2845), Course Name (Electrical Equipment), Course No. (N/A), Course Name (N/A).

Course Description

Presents descriptions of components in a programmable logic controller (PLC). Create ladder logic diagrams and use high-level softwares for programming a PLC. Selection of hardware components such as encoders, proximity sensors and actuators. Study of DC motor characteristics and load requirements. Compares open and closed loop systems.

Evaluation

Table with evaluation weights: Laboratory Assignments (25%), Midterm Exam (30%), Final Exam (45%), TOTAL (100%).

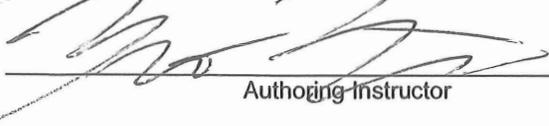
Course Learning Outcomes/Competencies

Upon successful completion, the student will be able to:

- 1. Describe the essential components of an industrial control system.
2. List the most common types of controllers used in industry.
3. Read industrial control schematics and ladder logic diagrams.
4. Program a PLC, using software contacts, coils, timers and counters to solve machine control problems.
5. Explain the difference between analog and digital signals.
6. Describe the operation and list typical applications of operational amplifiers.
7. Describe the operation of a closed loop position servo mechanism.
8. Describe the feedback sensors often used in mechanical controls applications.
9. Describe the proportional, integral and derivative control modes and their influence on control signals.
10. Discuss the operation and performance characteristics of DC and stepper motors.

■ Verification

verify that the content of this course outline is current.

  
\_\_\_\_\_  
Authoring Instructor

March 13, 2006  
\_\_\_\_\_  
Date

I verify that this course outline has been reviewed.

  
\_\_\_\_\_  
Program Head/Chief Instructor

March 16/06.  
\_\_\_\_\_  
Date

I verify that this course outline complies with BCIT policy.

  
\_\_\_\_\_  
Dean/Associate Dean

2006/03/20  
\_\_\_\_\_  
Date

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

### Instructor(s):

|                  |                           |  |
|------------------|---------------------------|--|
| Taco Niet        | Office Location: SW9-205  | Office Phone: 604-456-8032   |
|                  | Office Hours: TBA         | e-Mail Address: <a href="mailto:tniet@my.bcit.ca">tniet@my.bcit.ca</a>             |
| Brian Gaensbauer | Office Location: SW3-1975 | Office Phone: 604-432-8876   |
|                  | Office Hours: TBA         | e-Mail Address: <a href="mailto:bgaensbauer@my.bcit.ca">bgaensbauer@my.bcit.ca</a> |

### ■ Learning Resources

#### Required:

“Modern Control Technology: 3<sup>rd</sup> Edition” Killian, Christopher T., Thomson Delmar Learning, New York 2006.

“MECH 4450 Lab Manual, Spring 2006” Niet, Taco, 2006. (Supplied).

#### 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, 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 day late to a maximum of 3 days late.

Assignments and lab reports should be handed in to the assignment drop box outside Brian Gaensbauer's office in SW3-1975. It is the student's responsibility to get the assignment into the correct box and to submit the assignments 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** (using the BCIT official medical certificate – see below) 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 three (3) or more consecutive days of class, you must provide the department with a BCIT Student Medical Certificate (<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

Assignment details will be provided to students in class. The lab manual for the course will be handed out in the first week of classes.

### Schedule

| Week of/ Number | Outcome/Material Covered          | Reference/ Reading |
|-----------------|-----------------------------------|--------------------|
| 1 (Mar 20)      | Control System Introduction       | Chapter 1          |
| 2 (Mar 27)      | Controller Hardware               | Chapter 2          |
| 3 (Apr 3)       | Control Algorithms                | Chapter 11         |
| 4 (Apr 10)      | Control Algorithms                | Chapter 11         |
| 5 (Apr 17)      | Switches, Sensors, Relays         | Chapter 4, 6       |
| 6 (Apr 24)      | Midterm Exam                      |                    |
| 7 (May 1)       | Operational Amplifiers            | Chapter 3          |
| 8 (May 8)       | DC Motors                         | Chapter 7          |
| 9 (May 15)      | Stepper Motors, Final Exam Review | Chapter 8          |
| 10 (May 22)     | Final Exam Week – No Classes      |                    |

### Lab Schedule

| Week of/ Number | Monday Labs            | Thursday Labs         | Friday Labs           |
|-----------------|------------------------|-----------------------|-----------------------|
| 1 (Mar 20)      | No Lab                 | No Lab                | Lab 1                 |
| 2 (Mar 27)      | Lab 1                  | Lab 1                 | Lab 2                 |
| 3 (Apr 3)       | No Lab – Open House    | No Lab – Open House   | No Lab – Open House   |
| 4 (Apr 10)      | Lab 2                  | Lab 2                 | No Lab – Good Friday  |
| 5 (Apr 17)      | No Lab – Easter Monday | A – Lab 3 / B – Lab 4 | A – Lab 3 / B – Lab 4 |
| 6 (Apr 24)      | A – Lab 3 / B – Lab 4  | A – Lab 3 / B – Lab 4 | A – Lab 3 / B – Lab 4 |
| 7 (May 1)       | A – Lab 3 / B – Lab 4  | A – Lab 4 / B – Lab 3 | A – Lab 4 / B – Lab 3 |
| 8 (May 8)       | A – Lab 4 / B – Lab 3  | A – Lab 4 / B – Lab 3 | A – Lab 4 / B – Lab 3 |
| 9 (May 15)      | A – Lab 4 / B – Lab 3  | No Lab                | No Lab                |

Notes:

1. Due to limited equipment each lab section will be broken into two groups. Group A will perform Lab 3 first and then Lab 4 while group B will perform Lab 4 first and then Lab 3.
2. Labs 3 and 4 are each two week labs.