A POLYTECHNIC INSTITUTION

School of Manufacturing, Electronics and Industrial Processes

Program: Robotics & Automation

Course Outline

MATH 1342
Technical Mathematics for Robotics Technology

Start Date:	September 5, 2006					**End Date:**	December 15, 2006		
Total Hours:	90	**Total Weeks:**	15			**Term/Level:**	1	**Course Credits:**	6
Hours/Week:	6	**Lecture:**	4	**Lab:**	2	**Shop:**		**Seminar:**	**Other:**

Prerequisites

Course No.	Course Name
	Program Admission, Math 12, C+

MATH 1342 is a Prerequisite for:

Course No.	Course Name
MATH 2342	Calculus for Robotics
ELEX 2205	AC Circuits for Robotics
**ELEX 2220*	*Digital Tech and Elex Controls*
**PHYS 2164*	*Applied Physics for Robotics*

** Co-requisites of Math 2342*

v Course Description

Systems of linear equations, determinants, matrices. Rotations and transformations in three dimensions. Common and natural logarithms, logarithmic/semilogarithmic graphs, exponential growth and decay. Trigonometric functions, identities, solution of triangles, graphing and addition of sinusoidal functions. Complex numbers, rectangular/polar conversions, phasor representation of sinusoidal waveforms. Applications to electrical networks, circuit transients, AC theory and motion in space.

v Detailed Course Description

The goals of this course are:

- to provide the necessary mathematical skills that are required to succeed in the technology program.
- to provide support for first/second term electronics and robotic courses.

v Evaluation

Final Examination	40%
Term Tests (2)	50%
Quizzes (~6)	10%
TOTAL	100%

⇨ ***Policy**: Minimum passing grade for this course is 50%.*

- Exam and quiz problems will be of a similar style and caliber to those found on the "Problem Sets" assigned in class.

v Course Learning Outcomes/Competencies

The student is expected to be able to:

1. solve systems of equations using the method of determinants and write systems of equations for multi-loop electrical networks,
2. use matrices to perform simple geometrical transformations with application to robotic arm design,
3. solve exponential equations relating to electrical transients,
4. solve logarithmic equations with application to decibels,
5. make effective use of log-log and exponential graphs with application,
6. sketch sinusoidal waveforms of the form: $y = A\sin(\omega t + \phi)$ and demonstrate an understanding of phase lag/lead,
7. solve simple trigonometric equations,
8. use complex numbers to perform calculations using rectangular, polar, exponential forms and vector-like calculations,
9. use complex numbers to solve AC circuit problems,
10. understand the complex frequency spectrum, an application of Euler's formula (optional).

v Verification

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

Paul Smith — Authoring Instructor

30 August 2006 — Date

I verify that this course outline has been reviewed.

Program Head/Chief Instructor (Math)

30 August 2006 — Date

Program Head/Chief Instructor (Technology)

5 Sept 2006 — Date

I verify that this course outline complies with BCIT policy.

Dean/Associate Dean (Math)
for Elaine Decker

30 August 2006 — Date

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

v Instructor(s)

Paul Smith	Office Location:	SW2-262	Office Phone:	604-453-4021
	Office Hrs.:	As posted *(5 hrs/wk)* *(subject to change)*	E-mail Address:	paul_smith@bcit.ca
			Office Fax:	604-432-9173

v Learning Resources

Texts and Equipment:

Required Calculator:

- **Sharp EL-546W** scientific calculator
  - capable of performing polar/rectangular transformations, complex number calculations, matrix operations using matrices up to 4x4 in size, and solving systems of three equations in three unknowns.

Suggested References:

1. *Mathematics for Electronics, Part I, Pre-Calculus.* Eric Hiob
2. *Technical Mathematics with Calculus - SI Edition*, P. Calter and D. Egerton. (Prentice Hall)

   Or…
   - *Technical Mathematics with Calculus,* A. J. Washington. (Benjamin Publ.)
   - *Technical Mathematics with Calculus,* P. Kuhfittig. (Brooks/Cole Publ.)
3. *Basic Circuit Analysis,* John O'Malley. (Schaum Outline)

v Information for Students

Assignments: There will be no specific assignments required for this course. However, a number of problem sets (~25) will be distributed in class on a regular basis throughout the term (1-2 per week), and discussed during the labs. Students are encouraged to work together with other students when attempting to solve the provided sample problems.

- *(For more details, see: "Assignment Details" below.)*

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**.

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.

Attendance: The attendance policy as outlined in the current BCIT Calendar 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: A doctor's note is required for any illness causing you to miss assignments, quizzes, tests, projects, or exam. At the discretion of the instructor, you may complete the work missed or have the work prorated.

Attempts: Students must successfully complete a course within a maximum of three attempts at the course. Students with two attempts in a single course will be allowed to repeat the course only upon special written permission from the Associate Dean. Students who have not successfully completed a course within three attempts will not be eligible to graduate from the appropriate 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.

v Information for Students (cont'd.)

Course Credit: Applications for course credit or course exemption on the basis of previously completed mathematics courses are assessed on a case-by-case basis by the BCIT Mathematics Dept. taking into account **all** of the following:

- the correspondence between topics, content and level
- recency (generally no more than 3–5 years)
- the grade (generally at least a C+ or 65%)
- the context (course taken as part of a university or college science or engineering program, rather than, for example, an arts or social science program).

Course Makeup Equivalents: In most cases, students who fail a math course or withdraw from a math course may make up the course by taking makeup courses. These courses may be BCIT evening or correspondence courses, or equivalent courses from another institution. In some cases, students may be required to take more than one course or several distance education modules to gain credit. In some cases, students may be required to achieve a mark of greater than 50% in the makeup course in order to achieve credit for the failed course. If a student fails a course, a makeup letter signed by the mathematics program head will be sent to the student, the technology program head, and to Student Records. Any course substitutions would require prior written approval of the mathematics program head.

Accommodation: Any student who may require accommodation from BCIT because of a physical or mental disability should refer to BCIT's Policy on Accommodation for Students with Disabilities (Policy #4501), and contact BCIT's Disability Resource Centre (SW1-2300, 604-451-6963) at the earliest possible time. Requests for accommodation must be made to the Disability Resource Centre, and should not be made to a course instructor or Program area.

Any student who needs special assistance in the event of a medical emergency or building evacuation (either because of a disability or for any other reason) should also promptly inform their course instructor(s) and the Disability Resource Centre of their personal circumstances.

I.D. Required in Examination Centres: In order to write exams, students will be required to produce photo identification at examination centres. Photo I.D. must be placed on the desk and must remain in view on the desk while writing the exam, for inspection by invigilators. Students should bring a BCIT OneCard or alternatively two pieces of identification, one of which must be government photo I.D. such as a driver's licence. Please see BCIT Policy #5300, Formal Invigilation Procedures.

v Assignment Details (Problem Sets)

There are no specific assignments for this course. However, a number of "Problem Sets" will be "assigned" on a regular basis throughout the term which will provide a variety of problems related to the course material for the students to try for practice. The Problem Sets will be distributed in class at the rate of 1 or 2 each week as the associated topics are covered during the lectures. (There will be a total of about 25 problem sets in all.) The problem sets will include a mix of problems, which will provide practice in theoretical foundations as well as appropriate applications.

Solutions to the problem sets will not be collected from students, nor will they be corrected or marked by the instructor. However, answers to all the questions on each problem set will be provided, and in addition some selected problems may be solved in detail in the labs. Note that unless otherwise indicated, **students will be responsible for all the material covered on the problem sets** (including any material not specifically covered in class). **Exam problems will primarily be of a similar style and caliber to those found on the problem sets.**

Schedule

This schedule is subject to change at the discretion of the instructor, as circumstances may require.

Number of Lectures	Topics	References: Reading & Problem Sets
4	**Algebra Review** Equations, expressions, exponents, fractions, etc. Solving equations – linear and quadratic Equations of straight lines	Chapter 1 PS#0 PS#1
4	**Systems of Linear Equations** Six methods of solution Determinants and matrices	Chapter 2 *Section 2.1* PS#2
5	**Applications to DC Circuit Theory** Ohm's Law, Kirchoff's Laws Loop Analysis Nodal Analysis	Chapter 2 *Section 2.2* PS#3-6
6	**Matrix Algebra** Addition, subtraction and multiplication Matrix Inversion Solving systems of equations using matrix operations Transformation of vectors • Applications to basic transformations and robotic arm design	Additional Notes: *"Vectors, Matrices and Transformations"* PS#7-8
10	**Logarithmic and Exponential Functions** Exponents Common and natural logarithms Exponential and logarithmic equations Applications of logarithmic and exponential functions • decibel power scale • exponential growth/decay • DC circuits involving capacitors and inductors Graphing logarithmic and exponential functions	Chapter 3 Chapter 7 *Sections 7.1-7.2* PS#9-13
8	**Trigonometry and Phasors** The trigonometric functions Solution of triangles Sinusoidal waveforms • Graphing, frequency, period, phase shifts, etc. Phasor representation of sinusoidal waveforms Basic trigonometric identities	Chapter 4 Chapter 5 PS#14-18

Number of Lectures	Topics	References: Reading* & Problem Sets
3	**Complex Numbers** Polar, rectangular and exponential forms Algebra of complex numbers	Chapter 6 PS#19
7	**Applications to AC Circuit Theory** Series and Parallel Circuits Oblique Triangles (*Law of Cosines/Sines*) Loop and Nodal Analysis	Chapter 7 *Sections 7.3-7.9, 7.12* PS#20-23

* *Reading references are from the first suggested reference text: "Mathematics for Electronics, Part I, Pre-Calculus"* - Eric Hiob

Tentative Midterm Exam Dates (2006)

- **Midterm #1:** Friday, October 13th
- **Midterm #2:** Friday, November 10th

⇨ These midterm exam dates are subject to change. Any required changes will be announced in class at least 1 week in advance.

Quizzes: A series of about 6 short quizzes (1-2 questions) will be given throughout the term, once every 2-3 weeks. Notice of the specific quiz dates will be given at least 2 days in advance.

Instructor Schedule

- *Office Hours subject to change –updated schedule will always be posted outside instructors office SW2-262*

INSTRUCTOR		Paul Smith				YEAR	2006			9/7/2006
COURSE		MATH 1342				TERM	Fall			
Period	1	2	3	4	5	6	7	8	9	10
Time	#	8:30 AM	9:30 AM	10:30 AM	11:30 AM	12:30 PM	1:30 PM	2:30 PM	3:30 PM	4:30 PM
MON			OFFICE HOUR	OFFICE HOUR	Math 1342 SW1 - 2004 *Lab B*		Math 1342 SW3 - 1750			
TUE			Math 1342 SW1-2016	SW1 - 3570		Math 1342 SW1 - 2005 *Lab A*				
WED										
THU			SW1-2009	OFFICE HOUR	OFFICE HOUR			Math 1342 SW1 - 1021	SW1-1492	
FRI			OFFICE HOUR	Math 1342 SW1 - 1025		Math 1342 SW1-3570 *Lab B*	Math 1342 SW3 - 2745 *Lab A*			