



A POLYTECHNIC INSTITUTION

School of Computing and Academic Studies

Program: Physics Department

Option:

PHYS 1164**Physics for Robotics 1****Start Date:** 04 September 2006**End Date:** 15 December 2006**Total Hours:** 75 **Total Weeks:** 15**Term/Level:** 2006/30 **Course Credits:** 5.0**Hours/Week:** 5 **Lecture:** 3 **Lab:** 2**Shop:** **Seminar:** **Other:****Prerequisites****Course No. Course Name**

Physics 11, C+ or better

Math 12, C+ or better

PHYS 1164 is a Prerequisite for:**Course No. Course Name**

PHYS 2164 Physics for Robotics 2

■ Course Description

Physics 1164 is a general non-calculus physics course, which emphasizes topics of special relevance to robotics/automation. Part 1: Measurement and Data Analysis. Part 2: Basic Mechanics, including static equilibrium, work, energy, power, torque, and rotational motion. The laboratory program stresses measurement, data analysis, and experimental techniques.

■ Detailed Course Description

The goals of the course are to:

- Define the variables used to describe the kinematics and dynamics of translational motion.
- Apply force vector diagrams to solve static and dynamic problems for both 1 and 2 dimensional problems.
- Solve equilibrium problems involving both moments of forces and torques.
- Understand problems involving friction, including its useful and detrimental aspects.
- Use the principle of conservation of energy to solve problems in work, energy, power, and efficiency.
- Apply kinematics, dynamics, and energy concepts to rotational motion.

■ Evaluation

Quizzes	5%
Term Tests (2)	25%
Laboratory Exams (2)	25%
Laboratory Work	15%
Final Comprehensive Exam	30%
TOTAL	100%

Comments: Students must pass BOTH the laboratory AND the lecture portions separately in order to pass the course. If either portion is failed, a failing grade of Unsatisfactory will be issued.

■ Course Learning Outcomes/Competencies

Upon successful completion, the student will be able to:

- solve problems involving basic physics principles using proper problem solving techniques.
- solve problems involving physics concepts applied to robotics/automation systems.
- measure and analyze laboratory data to verify relationships and connecting principles between physical quantities.
- write concise laboratory reports in accordance with a prescribed format.

■ Verification

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

Authoring Instructor

Date

I verify that this course outline has been reviewed.

Program Head/Chief Instructor

Date

I verify that this course outline complies with BCIT policy.

Dean/Associate Dean

Date

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

■ Instructors

Kenneth Mark (Lecture and Lab)	Office Location:	SW3-4079	Office Phone:	604-412-7445
	Office Hours:	M: 11:30-13:20	E-mail Address:	kenneth_mark@bcit.ca
		T: 11:30-13:20		
	(other times by appointment)	W: 11:30-13:20		
		Th: 11:30-13:20		
Umit Olcay (Lab)		F: 10:30-12:20		
	Office Location:	SW3-4081	Office Phone:	604-412-7448
	Office Hours:	To Be Announced	E-mail Address:	umit_olcay@bcit.ca
	(other times by appointment)			

■ Learning Resources

Required:

- *Physics for Robotics*, Betts Modules, John Betts 2005 (available at bookstore)
- *Physics Lab Manual for Robotics*, Physics Department, BCIT, 2006 Revision (available at bookstore)
- *Physics Laboratory Notebook* (available at TNT store or bookstore)
- Scientific Calculator

Recommended:

Applied Physics, Schaum's Outlines, 3rd edition (or most recent)

■ Information for Students

Assignments: Late assignments, lab reports or projects will **not** be accepted for marking. Assignments must be done on an individual basis unless otherwise specified by the instructor.

Makeup Tests, Exams or Quizzes: All tests/exams/quizzes must be taken at the time scheduled. There will in general be no makeup tests, exams or quizzes. If you miss a test, exam or quiz, you will in general receive zero marks. Exceptions may be made for documented medical reasons or extenuating circumstances, but you must notify your instructor within 24 hours, preferably in advance of the test/quiz/exam. Any evaluations not made up or prorated will receive a grade of zero. **No more than 20% of the course evaluation may be prorated or missed**, otherwise an incomplete or failure will be assessed.

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 current BCIT policy on attendance will be enforced. Attendance will be taken at the beginning of each session. Students not present at that time will be recorded as absent. **Lab attendance is mandatory. Missing two or more labs will result in an Unsatisfactory grade in the course.** If you have a legitimate reason for missing a laboratory session, (e.g. sickness), inform the instructor *within 24 hours* and make arrangements to complete the laboratory at another time.

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.

Problem-Solving: Students are expected to show all work in solving problems. Marks will not be given for unsupported answers. Equations should be rearranged algebraically, solved symbolically for the unknown quantity, and, if appropriate, numbers and units should then be substituted in equations. The answer should be interpreted in English where appropriate and be written with units and with the proper number of significant figures or uncertainty.

Workload: The time that you will need to succeed in this course depends on your own background and abilities. It is very important to study regularly, keep up with the work and seek the assistance of the instructor when problems arise. *The course load is quite heavy and to succeed you must be prepared to make the appropriate personal time commitment.* An **average time** allotment is usually one hour for every classroom or lab hour per week.

Class Conduct: Students are expected to act professionally during class. Students disrupting classes/labs or disturbing others during class/lab may be asked to leave and their behaviour will be reported to their program head and documented.

Passing Grade: To obtain a passing grade in the course, the student must pass **both** the laboratory **and** the lecture portions of the course.

Laboratory Reports: Formal laboratory reports will generally be required for each laboratory session. Lab books will be initialled at the end of each lab session for attendance and data collection. Reports will be completed by the student and will be checked the next week in the lab session. Loose sheets or photocopied lab manual material (with the exception of data tables) within the lab notebook is not allowed and will result in failure of the lab.

Incomplete lab reports will receive a mark of zero. *All reports must be completed by term end.* Two or more incomplete laboratory reports will result in an Unsatisfactory grade in the course.

Assignments: Assignments will cover the topics discussed in class and lab. Assignments are for practice only; no grades will be given as the solutions will be supplied. Students are encouraged to solve the problems as the problems will be closely related to questions on quizzes and tests.

Term Tests: Tests will be related to course work, assignments, concepts covered in classes, laboratory sessions and tutorials. There will be two term tests. There are no make-up tests; you are expected to write the test on the scheduled day. A missed test will result in a mark of zero.

Laboratory Tests: Lab tests will be related to the assigned laboratory work and the corresponding theory from the lab and lecture. During the lab test, you will be allowed only your lab notebook with no loose sheets or photocopied material added. There will be two lab tests scheduled during the regular lab period. **There are no make-up lab tests.** You are expected to write the test at the scheduled time. A missed test will result in a mark of zero.

Final Exam: The final exam will test material covered in the entire term, both in lectures and in the labs.

■ Assignment Details

Homework is to be completed as material is covered in class. The problems assigned should be considered a minimum number. To obtain mastery over a particular subject more problems may be needed. Assignments are not to be handed in for marking.

PHYS 1164 Proposed Lecture Schedule 2006 (subject to change)

Week Number/ Week of	Topics Covered	Betts Modules Assigned Reading Pages
1 04 – 08 Sep	No Classes: Labour Day, Mon 04 September No Physics Lecture: Orientation & Registration, Tue 05 September <u>Introduction to the Course</u> The Nature of Physics and the Scientific Method, Significant Figures, Scientific and Engineering Notation, SI and Engineering Units (conventions & prefixes),	1-2 to 1-29
2 11 – 15 Sep	Unit Conversion, Dimensional Algebra <u>Vectors & Intro to Kinematics</u> Vector and Scalar Quantities, Displacement, Speed And Velocity, Acceleration, Collinear Vectors, Vector Addition by Scale Diagrams,	1-29 to 1-33 3-2 to 3-21
3 18 – 22 Sep	Vector Addition by the Method of Components, Vector Subtraction, Vector Multiplication Graphical Analysis of Motion, Equations for Uniformly Accelerated Motion, Freely Falling Bodies,	3-22 to 3-36 4-2 to 4-23
4 25 – 29 Sep	Projectiles <u>Dynamics</u> Newton's First Law, Newton's Second Law, Mass and Weight (force of gravity), Newton's Third Law, Free-Body Diagrams, Reaction Forces	4-24 to 4-30 5-2 to 5-21
5 02 – 06 Oct	<u>Equilibrium</u> First Equilibrium Condition, Scale Diagrams, Equilibrant and Resultant, Trigonometric Solution, Moment of Force and Torque,	6-2 to 6-17
6 09 – 13 Oct	Equilibrant and Resultant, Couples, Centre of Gravity, Second Equilibrium Condition, TEST #1: Friday, 13 October 2006 at 8:30 am [Tentative]	6-18 to 6-22
7 16 – 20 Oct	Types of Equilibrium, Trusses <u>Friction</u> Coefficients of Friction, Angle of Friction, Reduction of Friction, Bearings	6-23 to 6-36 8-3 to 8-12
8 23 – 27 Oct	<u>Work, Energy, and Power</u> Work Done by a Constant Force, Energy, Kinetic Energy, Gravitational and Elastic Potential Energy, Conservative and Non-conservative forces, Conservation of Mechanical Energy,	9-2 to 9-25
9 23 – 27 Oct	Power, Special Energy Units, Efficiency <u>Circular Motion</u> Circular Motion, Centripetal Force and Acceleration (Applications: road curves, road banking, aircraft in flight, centrifugal force),	9-26 to 9-34 11-2 to 11-15
9 30 Oct – 03 Nov	Kepler's Laws, Universal Law of Gravitation, Gravitational Potential Energy <u>Rotational Motion</u> Angular Measurement, Angular Kinematics (displacement, velocity, acceleration), Equations of Uniform Rotary Motion,	11-16 to 11-30 12-2 to 12-11

Week Number/ Week of	Topics Covered	Betts Modules Assigned Reading Pages
10 06 – 10 Nov	Torque and Moment of Inertia, Radius of Gyration, Parallel Axis Theorem <u>TEST #2: Friday, 10 November 2006 at 8:30 am [Tentative]</u>	12-15 to 12-24
11 13 – 17 Nov	Rotational Work, Energy, and Power, Torsion <u>Momentum</u> Impulse, Linear Momentum, and Newton's Second Law, Conservation of Momentum,	12-25 to 12-33 10-2 to 10-15
12 20 – 24 Nov	One, Two and Three Dimensional Interactions Angular Momentum	10-21 to 10-24 12-34 to 12-37
13 27 Nov – 01 Dec	<u>Simple Mechanical Machines</u> Mechanical Advantage, Levers, Pulleys, Gears (gear ratio, types of gears, gear trains), Inclined Planes (wedges, cams, screws and jacks), Compound Machines	13-2 to 13-37
14 04 – 08 Dec	Review Week	
15 11 – 15 Dec	<u>Final Examination Week</u>	

PHYS 1164 Laboratory Schedule - Fall 2006

All lab sessions occur on Wednesdays from 8:30-10:20 a.m. in room SW3-4790. Laboratory reports are to be submitted for marking by the due date and time for your set. Late reports will be penalized.

Prepare for each experiment by reading through the relevant pages in your PHYS 1164/2164 Laboratory Manual BEFORE coming to the lab.

Date	Scheduled Activity
06 Sep	No Lab
13 Sep	<u>Read Lab Manual pages 1-13 and Betts Modules pages 1-7 to 1-15 BEFORE Coming to the lab</u> Intro to Lab and M1
20 Sep	<u>Read Betts Modules pages 2-20 to 2-27 BEFORE coming to lab</u> – M1 continued
27 Sep	No Lab (due to Shinerama)
04 Oct	M1 / Quiz
11 Oct	K2
18 Oct	LD2
25 Oct	LAB TEST #1
01 Nov	Return Lab Test #1 – 9:30 am start
08 Nov	K3
15 Nov	RD1
22 Nov	RD3
29 Nov	LAB TEST #2
06 Dec	Return Lab Test #2 & Lab Books – 9:30 am start
13 Dec	No Lab (Final Exam Week)