CALCULUS BASED PHYSICS I
PHYS 2110

Class Hours: 3.0   **Credit Hours: 4.0**

Laboratory Hours: 3.0   **Revised: Fall 06**

Catalog Course Description:

For students majoring in engineering, mathematics, and physics. This is a calculus-based approach to topics in electricity and magnetism. Course includes 3 hours of lecture and 3 hours of laboratory applications.

Entry Level Standards:

It is preferred to take this course after completing differential equations. Students taking this course must have completed a sequence of physics courses covering Mechanics, Heat, properties of matter, and oscillatory motion (including sound). Students majoring in engineering must have finished the sequence: Engineering Statics and Dynamics.

Prerequisites:

MATH 1920

Corequisites:

ENS 1510

Textbook(s) and Other Course Materials:

University Physics, Revised Edition by Harris Benson, Wiley
Physics 2110 Lab Manual

I. Week/Unit/Topic Basis:

Week	Topic
1	Lecture: 22.1 thru 22.5, Electrostatics Lab: Group Problems Session
2	Lecture: 23.1 thru 23.8, The Electric Field Lab: Group Problems Session Test 1
3	Lecture: 24.1 thru 24.4, Gauss's Law Lab: Group Experiment #1
4	Lecture: 25.1 thru 25.6, Electric Potential Lab: Group Problems Session Test 2
5	Lecture: 26.1 thru 26.7, Capacitors & Dielectrics

	Lab: Group Experiment #2
6	Lecture: 27.1 thru 27.6, Current and Resistance
	Lab: Group Experiment #3
	Test 3
7	Lecture: 28.1 thru 28.5, Direct Current Circuits
	Lab: Group Experiment #4
8	Lecture: 29.1 thru 29.8, The Magnetic Field
	Lab: Group Experiment #5
9	Lecture: 30.1 thru 30.4, Magnetic Field Sources
	Lab: Group Experiment #6
	Test 4
10	Lecture: 31.1 thru 31.8 Electromagnetic Induction
	Lab: Group Experiment #7
	Test 5
11	Lecture: 32.1 thru 32.6 Inductance
	Lab: Group Experiment #8
12	Lecture: 33.1 thru 33.4 AC Circuits
	Lab: Group Experiment #9
	Test 6
13	Lecture: 33.5 thru 33.9 AC Circuits
	Lab: Group Experiment #10
14	Lecture: 34.1 thru 34.8 Maxwell's Equations
	Lab: Group Problems Session
15	Final Exam (Comprehensive)

II. Course Objectives*:

A.   Explain metric and American units and systems and perform various conversions between the two, (The gauges at work sites often use both types of units). V.1, V.3

B.   Describe the nature of forces between electric charges. V.1, V.4

C.   Analyze Coulomb's Law for the force between two point charges. V.1, V.4

D.   Calculate and map the electric field for simple charge distributions. V.1, V.4

E.   Apply the Gauss's Law to different simple charge distributions in order to determine the electric field. V.1, V.4

F.   Explain the electric potential and the concept of electric potential energy. V.1, V.2, V.3, V.4

G.   Use the concepts of field and potential to analyze the capacitors and their electric energy storage capacity and the role of dielectrics. V.1, V.2, V.3, V.4

H.   Analyze and calculate the current through, voltage across, and the energy dissipation in resistors as typical elements of a circuit. V.2, V.4

I.   Analyze and calculate the current and voltage in multi-loop circuits. V.2, V.4

J.   Calculate the magnetic field and its effect on moving charges. V.2, V.4

K.   Describe the effect of electric and magnetic fields used in cyclotrons and other particle accelerators. V.1, V.3

L.   Describe the Faraday's Law of electromagnetic induction and the induced electromotive force. V.1, V.3

M.   Analyze simple AC circuits such as LC-, LR-, RC, RLC- Series circuits. V.2, V.4

N.   Qualitatively explain the Maxwell's equations. V.3, V.4

*Roman numerals after course objectives reference goals of the university parallel program.

III. Instructional Processes*:

Students will:

1.   Learn in a cooperative mode by working in small groups with other students and exchanging ideas within each group (or sometimes collectively) while being coached by the instructor who provides assistance when needed. *Active Learning Strategy*

2.   Learn by being a problem solver rather than being lectured. *Active Learning Strategy*

3.   Explore and seek the solutions to the given problems which measures his/her level of accomplishment. *Active Learning Strategy*

4.   Visit industry sites or will be visited by a person from industry who applies the concepts being learned at his/her work site. *Transitional Strategy*

5.   Gradually be given higher- and higher-level problems to promote his/her critical thinking ability. *Active Learning Strategy*

6.   Search for the solution to the assigned projects by examining the available software and resources. *Transitional Strategy*

7.   Get engaged in learning processes such as projects, mentoring, apprenticeships, and/or research activities as time allows. *Transitional Strategy*

8.   Use computers with appropriate software during class or lab as a boost to the learning process. *Technology Literacy Outcome*

*Strategies and outcomes listed after instructional processes reference TBR's goals for strengthening general education knowledge and skills, connecting coursework to experiences beyond the classroom, and encouraging students to take active and responsible roles in the educational process.

IV. Expectations for Student Performance*:

Upon successful completion of this course, the student should be able to:

1.   Apply the physics concepts to theoretical and practical situations. A-N

2.   Estimate an unknown parameter in a given practical situation by using the physics principles involved. C,G,H,I,J,K,L,M

3.   Master simple energy calculations to estimate energy requirement and feasibility in a given situation. F, G, H, K

4.   Perform necessary conversions between metric and non-metric units and systems. A

5.   Apply the Kirchhoff's rules to analyze circuits. H, I, M

6.   Apply the kinetics equation in force-motion situations. B, C

7.   Calculate the work done, energy involved, and energy conversions in a given problem. F, G, J

8.   Solve problems involving the motion of charged particles in a magnetic field. J, K, L, M

9.   Analyze the motion of charged particles in a magnetic field and its application in cyclotrons. J, K

10.   Apply a vector approach where vectors are involved. B, C, D, E, F, J, K, L, M, N

11.   Resolve a vector into two components graphically and analytically. B-G, J-N

12.   Calculate the effect of a changing magnetic flux through a surface, and the generated emf. L

13.   Calculate the effect of inductors, capacitors on alternating circuits. M

14.   Write down and interpret the Maxwell's equations. N

*Letters after performance expectations reference the course objectives listed above.

V. Evaluation:

A. Testing Procedures:

Students are primarily evaluated on the basis of test/quiz type assessments and homework as outlined on the syllabus supplement distributed by the instructor. The following formula is used to evaluate the course grade:

Course Grade = (0.75) x (Theory Grade) + (0.25) x (Lab Grade)

Theory Grade = 0.80 (Tests + Quizzes + H.W.) + 0.20 (Comprehensive Final)
                      (80%)   (10%)   (10%)

The number of tests vary from 5 to 7. The percentages given for tests, quizzes, and homework may vary depending on the instructor.

B. Laboratory Expectations:

Ten experiments listed below are designed for the course. Each experiment requires a report that must be at least spell-checked. Procedures for a standard lab report will be given by your lab instructor. No late lab report will be accepted and there are NO lab make-ups.

Lab Grade = (the sum of report grades) / (the number of the reports)

C. Field Work:

Site Visits: The necessary site visits will be announced as the arrangements are made. Evaluation will be based on of attendance as well as the visit report.

D. Other Evaluation Methods:

N/A

E. Grading Scale:

91-100 : A   77-81 : C+
87- 91 : B+   70-77 : C
81- 87 : B   60-70 : D

VI. Policies:

A. Attendance Policy:

Pellissippi State Technical Community College expects students to attend all scheduled instructional activities. As a minimum, students in all courses must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course. Individual departments/programs/disciplines, with the approval of the vice president of Academic and Student Affairs, may have requirements that are more stringent.

B. Academic Dishonesty:

Plagiarism, cheating, and other forms of academic dishonesty are prohibited. Students guilty of academic misconduct, either directly or indirectly through participation or assistance, are immediately responsible to the instructor of the class. In addition to other possible disciplinary sanctions which may be imposed through the regular Pellissippi State procedures as a result of academic misconduct, the instructor has the authority to assign an F or a zero for the exercise or examination or to assign an F in the course.

C. Accommodations for disabilities:

If you need accommodations because of a disability, if you have emergency medical information to share, or if you need special arrangements in case the building must be evacuated, please inform the instructor immediately. Please see the instructor privately after class or in his/her office. Students must present a current accommodation plan from a staff member in Services for Students with Disabilities (SSWD) in order to receive accommodations in this course. Services for Students with Disabilities may be contacted by going to Goins 127 or 131 or by phone: 694-6751(Voice/TTY) or 539-7153.

C. Other

* Experiments:

1 Fields and Equipotentials
2 Ohm's Law
3 Resistors in Series and Parallel
4 Multi-loop Circuits: Kirchhoff's Rules
5 Joule Heat
6 The RC Circuit with a DC source