PELLISSIPPI STATE TECHNICAL COMMUNITY COLLEGE
MASTER SYLLABUS

NONCALCULUS BASED PHYSICS II
PHYS 2020

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

Laboratory Hours: 3.0 **Revised: Spring 05**

Catalog Course Description:

This course is a continuation of Non-calculus Based Physics I. It covers electricity and magnetism, optics and modern physics. Course includes 3 hours of lecture and 3 hours of laboratory applications.

Entry Level Standards:

Students entering this course must have completed Physics 2010.

Prerequisite:

PHYS 2010

Textbook (s) and Other Course Materials:

Physics by Cutnell & Johnson, 6th Edition, Wiley 1997.
Physics 2020 Lab Manual

I. Week/Unit/Topic Basis:

Week	**Topic**
1	Lecture: Ch.18 Electric Forces and Fields 18.1 The Origin of Electricity 18.2 Charged Objects and Elec. Forces 18.3 Conductors and Insulators 18.4 Charging by Contact & by Induction 18.5 Coulomb's Law 18.6 The Electric Field 18.7 Electric Field Lines 18.8 The Elec. Field Inside a Conductor 18.9 Gauss' Law Lab: Group Problems Session
2	Lecture: Ch.19 Electric Potential Energy 19.1 Potential Energy 19.2 The Electric Potential Difference 19.3 Elec. Pot. Diff. by Point Charges 19.4 Equi-potential Surfaces 19.5 Capacitors and Dielectrics

Test 1
Lab: Group Experiment #1: Fields and Equipotentials

3 Lecture: Ch.20 Electric Circuits
20.1 Electromotive Force and Current
20.2 Ohm's Law
20.3 Resistance and Resistivity
20.4 Electric Power
20.5 Alternating Current
20.6 Series Wiring
20.7 Parallel Wiring
20.8 Mixed Series and Parallel Wiring
Lab: Group Experiment #2: Ohm's Law

4 Lecture: Ch.20 Electric Circuits
20.9 Internal Resistance
20.10 Kirchhoff's Rules
20.11 The Measurment of Current & Voltage
20.12 Capacitors in Series and Parallel, Kirchhoff's Rules
20.13 RC Circuits
20.14 Physiological Effects of Current

Test 2
Lab: Group Experiment 3: Resistances in Series and Parallel

5 Lecture: Ch.21 Magnetic Forces and Fields
21.1 Magnetic Field
21.2 Force of a Magnetic. Field on a Moving Charge
21.3 Motion of a Charge in a Mag. Field
21.4 The Mass Spectrometer
21.7 Magnetic Fields Produced by Currents
Lab: Group Experiment 4: Multi-Loop Circuits; Kirchhoff's Rules

6 Lecture: Ch.22 Electromagnetic Induction
22.1 Induced Emf and Induced Current
22.2 Motional Electromotive Force
22.3 Magnetic Flux
22.4 Faraday's Law of Electromagnetism
22.5 Lenz's Law
22.7 The Electric Generator
22.8 Mutual Inductance and Self Inductance
22.9 Transformers

Test 3
Lab: Group Experiment 5: RC-Circuit with a DC Source

7 Lecture: Ch.23 Alternating Current Circuits
23.1 Capacitors & Capacitive Reactance
23.2 Inductors and Inductive Reactance
23.3 RCL Circuits
23.4 Resonance in Electric Circuits

Test 4
Lab: Group Experiment 6: The Joule Heat

8	Lecture: Ch.24 Electromagnetic Waves 24.1 The Nature of Electromagnetic. Waves 24.2 The Electromagnetic Spectrum 24.3 The Speed of Light 24.4 The Energy Carried by E & M Waves 24.5 The Doppler Effect and E & M Waves 24.6 Polarization **Test 4** Lab: Group Experiment 7: The Mass of Electron
9	Lecture: Ch.25 The Reflection of Light 25.1 Wave Fronts and Rays 25.2 The Reflection of Light 25.3 Image in a Plane Mirror 25.4 Spherical Mirrors 25.5 Images in Spherical Mirrors 25.6 Mirror Equation and Magnification Lab: Group Experiment 8: Magnetic Induction, Electric Motors, Problems Session
10	Lecture: Ch.26 The Refraction of Light: Lenses 26.1 The Index of Refraction 26.2 Snell's Law of Refraction 26.3 Total Internal Reflection 26.4 Polarization and the Reflection and Refraction of Light 26.5 The Dispersion of Light 26.6 Lenses 26.7 The Formation of Images by Lenses 26.8 The Thin-Lens Equation 26.9 Lenses in Combination 26.10 The Human Eye 26.11 Angular Magnification and The Magnifying Glass 26.12 The Compound Microscope 26.13 The Telescope 26.14 Lens Aberration **Test 5** Lab: Group Experiment 9: Reflection of Light, Flat and Spherical Mirrors
11	Lecture: Ch.27 The Wave Nature of Light 27.1 Principle of Linear Superposition 27.2 Young's Double-Slit Experiment Interference of Light 27.3 Thin Film Interference 27.5 Diffraction 27.7 Diffraction Grating 27.9 X-Ray Diffraction Lab: Group Experiment 10: Refraction of Light, Snell's Law and Image in Converging Lenses
12	Lecture: Ch.29 Particles and Waves 29.1 The Wave-Particle Duality 29.2 Blackbody Radiation & Planck's Constant 29.3 Photons and Photoelectric Effect 29.5 The De Broglie Wavelength and The Wave Nature of Matter 29.6 The Heisenberg Uncertainty Principle

Test 6
Lab: Group Experiment 11: Interference of Light; Diffraction Grating

13 Lecture: Ch.30 The Nature of Atom
30.1 Rutherford Scattering and The Nuclear Atom
30.2 Line Spectra
30.3 The Bohr Model of Hydrogen Atom
30.5 The Quantum Mechanical Picture of the Hydrogen Atom
30.6 The Pauli Exclusion Principle and The Periodic Table of Elements
30.7 X-Rays
30.8 The Laser
Lab: Group Experiment 12: Line Spectra and Rydberg Constant

14 31.1 Nuclear Structure
31.2 The Strong Nuclear Force and the Nucleus Stability.
31.3 The Nucleus Mass Defect & Binding Energy
31.4 Radioactivity
31.5 The Neutrino
31.6 Radioactive Decay and Radioactivity
31.7 Radioactive Dating
31.8 Radioactive Decay Series
31.9 Radiation Detectors
Lab: Group Problems Session

15 **COMPREHENSIVE FINAL EXAM**

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. Calculate and analyze the forces involved and the electric field orientation of point charges and simple line charges. V.1 & V.4

C. Realize the application of electric fields in industry. V.1 & V.4

D. Explain the potential and potential difference and apply the concepts to a laboratory setting and problems solution. V.1 & V.4

E. Calculate capacitor related problems and realize the use of capacitors in electronics and industry. V.1, V.2, V.3,& V.4

F. Apply the Ohm's Law to simple circuit problems and calculate the relevant currents, voltages and powers. V.2, V.3,& V.4

G. Recognize series and parallel connections of circuit elements and apply the relevant formulas. V.2 & V.4

H. Apply the (emf) and internal resistance concepts to circuits containing batteries. V.1 & V.3

I. Apply Kirchhoff's rules to general circuits. I, II , V.3

J. Solve simple RC-Circuit problems and know their applications. I, II, IV, V.3

K. Explain magnetism, its cause, and the force of a magnetic field on a moving charge and its applications in industry. V.1 & V.3

L. Explain magnetic induction and the generation of induced electromotive force as well as alternating currents and applications. V.3

M. Realize the effect of alternating current on inductors and capacitors. V.1 & V.3

N. Solve simple RCL circuits. V.3

O. Explain the concepts of electromagnetic waves, spectrum, Doppler effect, polarization, and their relevant applications. V.1 & V.3

P. Explain the triple behavior of light in propagation, the concepts of reflection, refraction, wave-like behavior, and particle-like behavior. V.1, V.2, & V.4

Q. Use the reflection and refraction laws to solve plane mirror, spherical mirror, and lens problems and their application in optical devices. V.1 & V.2

R. Realize the wave-like behavior of light through interference and diffraction phenomena and calculate and measure the wavelength of an unknown wave by the methods learned. V.1, V.2, & V.4

S. Learn about the particle-like behavior of light, the wave particle, duality, the photoelectric effect, the wave nature of matter, and relate to the quantum mechanics concept. V.1, V.2, & V.4

T. Know about the nature of atom, line spectra, the Bohr model of hydrogen, X-rays, and Laser as an introduction to modern physics. V.1, V.2, & V.4

U. Search for the solution to the assigned projects by examining the available software and resources. V.1

*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 solutions to given problems that 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. (*Technological 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 through T),

2. estimate an unknown parameter in a given practical situation by using the physics principles involved (B, D, E, F, G, H, I, J, K, N, Q, R, S, and T),

3. recognize the use of equipment and machines from the units used in their gauges, (A, D, E, F, L, M, T),

4. master energy calculations to estimate energy requirement and feasibility in a given situation, (E, F, H, J, L, M, and T),

5. perform necessary conversions between metric and non-metric units and systems (A),

6. calculate and analyze the resultant force of a group of point charges on a single charge (B),

7. calculate the potential and potential energy associated with point charges and parallel-plate capacitors

8. calculate the charge, voltage, capacity, and energy stored in capacitors (E),

9. apply Ohm's Law to simple parallel and series circuit problems to calculate the current through, voltage across, and energy consumption associated with each element (F, G, H),

10. apply the Kirchhoff's rules to circuits to solve for the unknowns, (F, G, H, I),

11. solve problems on the charging and discharging of capacitors and explain the effect of the time-constant of the capacitors in the process with respect to relevant applications (I, J),

12. explain magnetism and its cause, and calculate the force exerted by a uniform magnetic field and a moving charge (K),

13. explain magnetic induction and apply the Faraday's law to calculate the emf produces by an induced magnetic flux (L),

14. calculate the capacitive and inductive reactance for capacitors and inductors in AC circuits, (M & N),

15. solve simple RCL series circuit problems (M & N),

16. apply force and torque equilibrium concepts in solving rigid-body problems (M, N, and O).

17. explain electromagnetic spectrum and the relation between, wave speed, frequency, and wavelength (O),

18. explain the Doppler effect and its use to calculate blue and red shifts (O),

19. explain the straight-line motion, wave-like, and particle-like behavior of light (P, Q),

20. solve mirror problem as well as lens problems (Q),

21. explain the wave-like behavior of light via interference and diffraction phenomena and calculate the variables in the Young's formula (P, R),

22 explain the particle-like behavior of light and calculate the quanta of energy associated with the photoelectric effect (P, S), and

23. explain the Pauli exclusion and Heisenberg uncertainty principles (T)

*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 quizzes and homework percentages depends on the instructor.

B. Laboratory Expectations:

Twelve experiments are designed for the course. Each experiment requires a word-processed report that must be at least spell-checked. Other procedures for a standard lab report will be given by your instructor. To avoid a ZERO Laboratory Grade, at least 6 reports must be turned in. No late lab report(s) 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 accommodation 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. Privately after class or in the instructor's office.
To request accommodations students must register with Services for Students with Disabilities: Goins 127 or 131, Phone: (865) 539-7153 or (865) 694-6751 Voice/TDD.