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  Date Revised: Spring 03

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 Reference Materials Basic to the Course:
Pellissippi States' Lab Manual for Physics 2020

I. Week/Unit/Topic Basis:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture: Ch.18  Electric Forces and Fields</td>
</tr>
<tr>
<td></td>
<td>18.1  The Origin of Electricity</td>
</tr>
<tr>
<td></td>
<td>18.2  Charged Objects and Elec. Forces</td>
</tr>
<tr>
<td></td>
<td>18.3  Conductors and Insulators</td>
</tr>
<tr>
<td></td>
<td>18.4  Charging by Contact &amp; by Induction</td>
</tr>
<tr>
<td></td>
<td>18.5  Coulomb's Law</td>
</tr>
<tr>
<td></td>
<td>18.6  The Electric Field</td>
</tr>
<tr>
<td></td>
<td>18.7  Electric Field Lines</td>
</tr>
<tr>
<td></td>
<td>18.8  The Elec. Field Inside a Conductor</td>
</tr>
<tr>
<td></td>
<td>18.9  Gauss' Law</td>
</tr>
<tr>
<td></td>
<td>Lab: Group Problems Session</td>
</tr>
<tr>
<td>2</td>
<td>Lecture: Ch.19  Electric Potential Energy</td>
</tr>
<tr>
<td></td>
<td>19.1  Potential Energy</td>
</tr>
<tr>
<td></td>
<td>19.2  The Electric Potential Difference</td>
</tr>
<tr>
<td></td>
<td>19.3  Elec. Pot. Diff. by Point Charges</td>
</tr>
<tr>
<td></td>
<td>19.4  Equi-potential Surfaces</td>
</tr>
<tr>
<td></td>
<td>19.5  Capacitors and Dielectrics</td>
</tr>
<tr>
<td>Test 1</td>
<td>Lab: Group Experiment One: Fields and Equipotentials</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>Lecture: Ch.20 Electric Circuits</td>
</tr>
<tr>
<td></td>
<td>20.1 Electromotive Force and Current</td>
</tr>
<tr>
<td></td>
<td>20.2 Ohm's Law</td>
</tr>
<tr>
<td></td>
<td>20.3 Resistance and Resistivity</td>
</tr>
<tr>
<td></td>
<td>20.4 Electric Power</td>
</tr>
<tr>
<td></td>
<td>Lab: Group Experiment #2: Ohm's Law</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test 2</th>
<th>Lab: Group Experiment 3: Resistances in Series and Parallel</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Lecture: Ch.20 Electric Circuits</td>
</tr>
<tr>
<td></td>
<td>20.5 Alternating Current</td>
</tr>
<tr>
<td></td>
<td>20.6 Series Wiring</td>
</tr>
<tr>
<td></td>
<td>20.7 Parallel Wiring</td>
</tr>
<tr>
<td></td>
<td>20.8 Mixed Series and Parallel Wiring</td>
</tr>
<tr>
<td></td>
<td>20.9 Internal Resistance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test 3</th>
<th>Lab: Group Experiment 5: RC-Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Lecture: Ch.21 Magnetic Forces and Fields</td>
</tr>
<tr>
<td></td>
<td>21.1 Magnetic Field</td>
</tr>
<tr>
<td></td>
<td>21.2 Force of a Magnetic Field on a Moving Charge</td>
</tr>
<tr>
<td></td>
<td>21.3 Motion of a Charge in a Mag. Field</td>
</tr>
<tr>
<td></td>
<td>21.4 The Mass Spectrometer</td>
</tr>
<tr>
<td></td>
<td>21.7 Magnetic Fields Produced by Current</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test 3</th>
<th>Lab: Group Experiment 6: Magnetic Induction</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Lecture: Ch.22 Electromagnetic Induction</td>
</tr>
<tr>
<td></td>
<td>22.1 Induced Emf and Induced Current</td>
</tr>
<tr>
<td></td>
<td>22.2 Motional Emf</td>
</tr>
<tr>
<td></td>
<td>22.3 Magnetic Flux</td>
</tr>
<tr>
<td></td>
<td>22.4 Faraday's Law of Electromagnetism</td>
</tr>
<tr>
<td></td>
<td>22.5 Lenz's Law</td>
</tr>
<tr>
<td></td>
<td>22.7 The Electric Generator</td>
</tr>
<tr>
<td></td>
<td>22.8 Mutual Inductance and Self Inductance</td>
</tr>
<tr>
<td></td>
<td>22.9 Transformers</td>
</tr>
<tr>
<td></td>
<td>Lab: Group Experiment 6: Magnetic Induction</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Lecture: Ch.23 Alternating Current Circuits</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>23.1 Capacitors &amp; Capacitive Reactance</td>
</tr>
<tr>
<td></td>
<td>23.2 Inductors and Inductive Reactance</td>
</tr>
<tr>
<td></td>
<td>23.3 RCL Circuits</td>
</tr>
<tr>
<td></td>
<td>23.4 Resonance in Electric Circuits</td>
</tr>
</tbody>
</table>
Test 4
Lab: Group Experiment 7: The Joule Heat

9
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
Lab: Group Experiment 8: The Mass of Electron

10
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

Test 5
Lab: Group Experiment 9: Reflection and Refraction

11
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
Lab: Ch. 31, Nuclear Physics and Radioactivity

12
Lecture: Ch.26 The Refraction 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 6
Lab: Ch. 31, Nuclear Physics and Radioactivity

13
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: Interference of Light; Diffraction Grating
14  Lecture: Ch.28 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 7**  
Lab: Group Experiment 11: Line Spectra and Rydberg Constant  

15  Lecture: Ch.30  
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 Problems Session  

16  **COMPREHENSIVE FINAL EXAM (110 minutes)**  

**II. Course Objectives**:  

A. Define Metric units used in electricity, magnetism, and optics. I.5,VI.2  
B. Calculate and analyze the forces involved and the electric field orientation of point charges and simple line charges. VI.1-5  
C. Learn the application of electric fields. I.5  
D. Explain and experiment the potential and potential difference and apply the concepts to a laboratory setting and problems solution. I.5  
E. Experiment with capacitors, and calculate capacitor related problems and realize the use of capacitors in electronics and industry. I.5, V1.1-5  
F. Experiment with Ohm's Law and apply it to simple circuit problems and calculate the relevant currents, voltages and powers. I.5  
G. Experiment with and recognize series and parallel connections of circuit elements and apply the relevant formulas. I.5  
H. Experiment with and apply the (emf’) and internal resistance concepts to circuits containing batteries. I.5  
I. Experiment with and apply Kirchhoff's rules to general circuits. I.5  
J. Experiment with a simple RC-Circuit and solve such problems and know their applications. I.5  
K. Explain magnetism, its cause, and the force of a magnetic field on a moving charge and its applications in industry. I.5  
L. Experiment with and explain magnetic induction and the generation of induced electromotive force as well as alternating currents and applications. I.5
M. Explain the concepts of electromagnetic waves, spectrum, Doppler effect, and polarization and their relevant applications. I.5

N. Experiment with and explain the triple behavior of light in propagation, the concepts of reflection, refraction, wave-like behavior, and particle-like behavior. I.5

O. Experiment with the reflection and refraction laws and use related formulas to solve plane mirror, spherical mirror, and lens problems and their application in optical devices. I.5

P. Experiment with and 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. I.5

Q. 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. I.5

R. Experiment with and learn about the nature of atom, line spectra, the Bohr model of hydrogen, X-rays, and laser as an introduction to modern physics. I.5

S. Search for the solution to the assigned projects by examining the available software (s) and resources. VII

*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 (Communication Outcome, Problem Solving and Decision Making Outcome, Active Learning Strategy),

2. learn by being a problem solver rather than being lectured (Problem Solving and Decision Making Outcome, Active Learning Strategy),

3. explore and seek solutions to given problems that measures his/her level of accomplishment (Problem Solving and Decision Making Outcome, 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 (Problem Solving and Decision Making Outcome, Personal Development Outcome),

6. be tested more frequently for progress assessment while working independently on test problems (Problem Solving and Decision Making Outcome),

7. get engaged in learning processes such as projects, mentoring, apprenticeships, and/or research activities as time allows (Communication Outcome, Transitional Strategy),

8. be repeatedly given a review on the previous topics to enable him/her to see that physics is the science of equilibrium and how each physics phenomenon can be viewed from an equilibrium point of view (Problem Solving and Decision Making Outcome, Personal Development Outcome).
9. understand physics and recognize matter in all phenomena (even those that do not seem to be physical at the first glance) and analyze them to the extent of their physics knowledge in light of equilibrium (especially, the Law of conservation of mass and energy), and see how thinking in terms of equilibrium and equality can bring harmony to mankind (Problem Solving and Decision Making Outcome, Personal Development Outcome), and

10. Use computers with appropriate software during class or lab as a boost to the learning process. Information Literacy Outcome, Technological Literacy Outcome

*Strategies and outcomes listed after instructional processes reference Pellissippi State’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. prepare a laboratory report on each experiment and explain a scientific conclusion based on the experimental results,

2. discuss the undesirable results in all reports (where appropriate) to become proficient in expressing scientific arguments as opposed to non-biased reasoning,

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

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

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

6. calculate the potential and potential energy associated with point charges and parallel-plate capacitors (D),

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

8. apply the 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),

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

10. 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),

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

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

13. calculate the capacitive and inductive reactance for capacitors and inductors are exposed to alternating currents (M, N),

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

15. explain how electromagnetic waves are generated and travel through media and vacuum (O),
16. explain electromagnetic spectrum and the relation between, wave speed, frequency, and wavelength (O),
17. explain the Doppler effect and its use to calculate blue and red shifts (O),
18. explain the straight-line, wave-like, and particle-like behavior of light (P, Q),
19. solve mirror problems as well as lens problems (Q),
20. explain the wave-like behavior of light via interference and diffraction phenomena and calculate the variables in the Young's formula (P, R),
21. explain the particle-like behavior of light and calculate the quanta of energy associated with the photoelectric effect (P, S),
22. know the Bohr atom calculation of the atomic radius and be able to calculate the energy associated with different layers of the hydrogen atom (T), 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 at the discretion of instructor. The quizzes and homework percentages depends on the instructor.

B. Laboratory Expectations:

Eleven 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 or may be found at the Pellissippi State's Web Page, under Physics. 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:

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>91-100</td>
<td>A</td>
</tr>
<tr>
<td>87-91</td>
<td>B+</td>
</tr>
<tr>
<td>81-87</td>
<td>B</td>
</tr>
<tr>
<td>70-77</td>
<td>C</td>
</tr>
<tr>
<td>60-70</td>
<td>D</td>
</tr>
</tbody>
</table>

VI. Policies:

Attendance Policy:

Pelissippi 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.