Catalog Course Description:

This course is a continuation of Noncalculus 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:


I. Week/Unit/Topic Basis:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
</table>
| 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  Equipotential Surfaces  
19.5  Capacitors and Dielectrics  
Lab: Group Exeriment One: Fields and Equipotentials |
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  
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  
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 Rad. & Planck's Constant  
29.3  Photons and Photoelectric Effect  
29.5  The DeBroglie Wavelength and The Wave Nature of Matter  
29.6  The Heisenberg Uncertainty Principle  
Lab: Group Experiment 11: Line Spectra and Rydberg Constant

15  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
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). 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. Realize the application of electric fields industry. I.5

D. Explain the potential and potential difference and apply the concepts to practical situations and problems solution. I.5

E. Calculate capacitor related problems and realize the use of capacitors in electronics and industry. I.5, V1.1-5

F. Apply the Ohm's Law to simple circuit problems and calculate the relevant currents, voltages and powers. I.5

G. Recognize the series and parallel connection of circuit elements and apply the relevant formulas. I.5

H. Apply the emf and internal resistance concepts to circuits containing batteries. I.5

I. Apply Kirchhoff's rules to general circuits. I.5

J. Solve simple RC-Circuit 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. Explain magnetic induction and the generation of induced electromotive force as well as alternating currents and applications. I.5

M. Realize the effect of alternating current on inductors and capacitors. I.5

N. Solve simple RCL circuits. I.5

O. Explain the concepts of electromagnetic waves, spectrum, Doppler effect, and polarization and their relevant applications. I.5

P. Explain the triple behavior of light in propagation, the concepts of reflection, refraction, wave-like behavior, and particle-like behavior. I.5

Q. Use the reflection and refraction laws to solve plane mirror, spherical mirror, and lens problems and their application in optical devices. I.5

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. I.5

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. I.5

T. Know about the nature of atom, line spectra, the Bohr model of hydrogen, X-rays, and Laser as an introduction to modern physics. I.5

U. 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 (enthusiastically) seek the solutions to the given problems which 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. 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. Apply the physics concepts to theoretical and practical situations. A-T

3. Recognize the use of equipment and machines from the units used in their gauges. A, C, 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, 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. D

8. Calculate the charge, voltage, capacity, and energy stored in capacitors. E

9. 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

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 reactances for capacitors and inductors are exposed to alternating currents. M, N

15. Solve simple RCL series circuit problems. M, N

16. Explain how electromagnetic waves are generated and travel through media and vacuum. 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

23. 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

24. 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:

\[
\text{Course Grade} = (0.75) \times (\text{Theory Grade}) + (0.25) \times (\text{Lab Grade})
\]

\[
\text{Theory Grade} = 0.80 \times (\text{Tests} + \text{Quizzes} + \text{H.W.}) + 0.20 \times (\text{Comprehensive Final})
\]

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:

Ten experiments are designed for the course. Each experiment requires a word-processed report which must be at least spell-checked. Other procedures for a standard lab report will be given by your instructor. No late lab report will be accepted and there are NO lab make-ups.

\[
\text{Lab Grade} = \frac{(\text{the sum of report grades})}{(\text{the number of the reports})}
\]

C. Field Work:

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

D. Other Evaluation Methods:

N/A

E. Grading Scale:

<table>
<thead>
<tr>
<th>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:

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.