Florida Agricultural and Mechanical University
Professional Education Unit
Tallahassee, Florida 32307

COURSE SYLLABUS

<table>
<thead>
<tr>
<th>Course Number:</th>
<th>PHY 2049L L01</th>
<th>Prerequisite(s):</th>
<th>PHY 2049</th>
<th>Course Title:</th>
<th>GENERAL PHYSICS LABORATORY II</th>
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<tr>
<th>College:</th>
<th>ARTS AND SCIENCE</th>
<th>Department:</th>
<th>PHYSICS</th>
<th>Required Text(s):</th>
<th>GENERAL PHYSICS II LABORATORY MANUAL</th>
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<td>Supplies:</td>
<td>FAMU Bookstore</td>
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<table>
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<tr>
<th>Faculty Name:</th>
<th>Belay, Kalayu G.</th>
<th>Term and Year:</th>
<th>Fall 2008</th>
<th>Place and Time:</th>
<th>8AM- 10:30AM, Thu FAMU DEV RESEARCH SCHOOL 119</th>
</tr>
</thead>
</table>

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<tr>
<th>Office Location:</th>
<th>HSRB 308A</th>
<th>Telephone:</th>
<th>(850) 599-3815</th>
<th>e-mail:</th>
<th><a href="mailto:Kalayu.belay@famu.edu">Kalayu.belay@famu.edu</a></th>
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</thead>
</table>

Office Hours

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
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<th>Friday</th>
<th>Saturday</th>
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<tbody>
<tr>
<td>9am-10am</td>
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Course Description
This is an introductory course that is designed to illustrate the principles and concepts of physics taught in General physics II. Each laboratory experiment is designed to give students experience in making measurements, gathering and interpreting data, manipulating certain laboratory equipment and carrying out calculations studied in lecture. It is a practical and up-to-date hands on experiments in physics for students in PHY2049.

Course Purpose
The course is to help students and prospective teachers to
A. Extract information from experiments in laboratory manual.
B. Collect and interpret data of various experiments.
C. Demonstrate independent work
D. Set-up experiment and obtain results through skilled time management.
E. Recognize and apply principles in the main area of General Physics II.

F=Florida Educator Accomplished Practices Standards (FEAPS)
I=Interstate New Teacher Assessment and Support Consortium Standards (INTASC)
(K)=Knowledge  (S)=Skill  (D)=Disposition
State and National Professional Standards for Training

In response to Florida’s demand for accountability from their public schools, the 1997 State Legislature created the Florida System of School Improvement and Accountability, which is designed to improve student performance. The Physics Department, in response to this initiative, strives to make a positive impact by ensuring that it produces high quality professional specialists in physics education who are committed to improving student performance and who will assist students in meeting the Florida Sunshine State Standards. The Physics Department Physics Education program endeavors to provide a quality program through the implementation of an integrated curriculum based on the guidelines and competencies aligned with the Florida Sunshine State Standards, Florida Accomplished Practices, Florida Adopted Subject Area Competencies, and those guidelines and standards from other learned societies and professional organizations.

The Conceptual Framework in the Professional Education Unit at Florida A&M University’s College of Education is an integrated approach to providing educational experiences that result in exemplary professional educators. The Framework is comprised of many activities and themes with the mission of developing high quality classroom teachers, administrators and support personnel. The term “exemplary” refers to the kind of graduates the unit strives to produce. Figure 1 provides a diagram of the Exemplary Professional Conceptual Framework:

The Unit’s Conceptual Framework is consistent with and complements the College of Education and the University’s Mission statements. The shared vision of the Professional Education Unit is to prepare exemplary professionals who are able to go into the educational institutions of Florida, the nation and the world armed with knowledge, skills, and dispositions that will facilitate learning for students, support interactions and partnerships with community stakeholders, and engender on-going professional development for themselves and others. The conceptual framework provides direction for programs, courses, teaching, candidate performance, scholarship, service, and Unit accountability.

The Physics Education Program at Florida A&M University is committed to training professionals who have expertise in the depth and diversity of both in physics and education.

Conceptual Framework

The Conceptual Framework in the Professional Education Unit (PEU) at Florida A&M University is an integrated approach to providing educational experiences that result in exemplary professional educators. The Framework is comprised of six themes with the mission of developing high quality classroom teachers, administrators and support personnel. The term “exemplary” refers to the kind of graduates the PEU strives to produce. The figure below provides a diagram of the Exemplary Professional Conceptual Framework.

CRITICAL THINKING

- CF4
  - Through this focal area, the FAMU professional education candidate will:

  | CF: 4.5 (S) | Demonstrate the use of higher order thinking skills. | F: 4 | I: 4 |

PROFESSIONALISM

- CF 5
  - Through this focal area, the FAMU professional education candidate will:

  | CF: 5.1 (K) | Know the content | F: 8 | I: 1 |

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National and State Standards Addressed in the Course

Interstate New Teacher Assessment and Support Consortium (INTASC) Standards

Standard 1: Subject Matter: The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and can create learning experiences that make these aspects of subject matter meaningful for students.

1.10 Knowledge
1.12 The teacher understands how students' conceptual frameworks and their misconceptions for an area of knowledge can influence their learning.

1.13 The teacher can relate his/her disciplinary knowledge to other subject areas.

Standard 4: Instructional Strategies: The teacher understands and uses a variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills.

4.10 Knowledge
4.11 The teacher understands the cognitive processes associated with various kinds of learning (e.g. critical and creative thinking, problem structuring and problem solving, invention, memorization and recall) and how these processes can be stimulated.

4.12 The teacher understands the principles and techniques, along with advantages and limitations, associated with various instructional strategies (e.g. cooperative learning, direct instruction, discovery learning, whole group discussion, independent study, interdisciplinary instruction).

4.13 The teacher knows how to enhance learning through the use of a wide variety of materials as well as human and technological resources (e.g. computers, audio-visual technologies, videotapes and discs, local experts, primary documents and artifacts, texts, reference books, literature, and other print resources).

Standard 8: Assessment: The teacher understands and uses formal and informal assessment strategies to evaluate and ensure the continuous intellectual, social and physical development of the learner.

8.10 Knowledge
8.11 The teacher understands the characteristics, uses, advantages, and limitations of different types of assessments (e.g. criterion-referenced and norm-referenced instruments, traditional standardized and performance-based tests, observation systems, and assessments of student work) for evaluating how students learn, what they know and are able to do, and what kinds of experiences and technology will support their further growth and development.

8.12 The teacher knows how to select, construct, and use assessment strategies, technology and instruments appropriate to the learning outcomes being evaluated and to other diagnostic purposes.

8.13 The teacher understands measurement theory and assessment-related issues, such as validity, reliability, bias, and scoring concerns.

Florida Educator Accomplished Practices (FEAP)

4. Uses appropriate techniques and strategies, which promote and enhance critical, creative, and evaluative thinking capabilities of students. CRITICAL THINKING
8. Demonstrates knowledge and understanding of the subject matter. SUBJECT MATTER KNOWLEDGE

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**Competencies and Skills required for Teacher Certification in Florida (FTCE)**

1. **Knowledge of Nature of Scientific Investigation and Instruction In Physics**
   1.1 Identify the characteristics and processes of scientific inquiry.
   1.4 Relate the historical development of the major concepts, models, and investigations in physics to current knowledge (e.g., force and motion, conservation principles, fields, quantum theory).
   1.5 Distinguish between scientific theories and laws in terms of their specific roles and functions.

2. **Knowledge of the Mathematics of Physics**
   2.1 Determine the validity of a formula based on dimensional analysis.
   2.2 Combine vectors using graphic and trigonometric methods.
   2.3 Determine the dot product and cross product of two vectors.
   2.4 Convert between units of a given quantity (e.g., length, area, volume, mass, time, temperature).
   2.5 Identify prefixes in the metric system and standard units of measure (e.g., newtons, meters, kilowatt-hours, teslas, electron volts, calories, horsepower).
   2.6 Estimate the order of magnitude of a physical quantity.
   2.7 Interpret the slope of a graph or area under the curve in relation to physical concepts.
   2.8 Apply the concepts of accuracy, precision, uncertainty, and significant figures to measurements and calculations.

3. **Knowledge of Thermodynamics**
   3.1 Relate changes in length, area, or volume of a system to changes in temperature.
   3.2 Distinguish between the three methods of heat transfer (i.e., conduction, convection, radiation).
   3.3 Determine the amount of heat transferred by conduction or radiation.
   3.4 Interpret segments of graphs of temperature versus heat added or removed (e.g., latent heats, specific heats).
   3.5 Analyze pressure, volume, and temperature relationships using the ideal gas law.
   3.6 Apply the first law of thermodynamics (i.e., energy conservation) to physical systems.
   3.7 Calculate work done by or on a gas from pressure versus volume diagrams.
   3.8 Interpret pressure versus volume diagrams (e.g., identify isobaric, isothermal, and adiabatic processes).
   3.9 Determine the specific heat, latent heat, or temperatures of a substance, given appropriate calorimetric data.
   3.10 Apply the second law of thermodynamics (i.e., entropy increase) to physical processes.
   3.11 Relate temperature or pressure to kinetic molecular theory.

6. **Knowledge of electricity and magnetism**
   6.1 Determine the electric force on a point charge due to one or more other charges.
   6.2 Determine the electric potential difference between two points in an electric field.
   6.3 Analyze problems involving capacitance, with or without dielectrics.
   6.4 Analyze the electric field due to a charge distribution.
   6.5 Apply Gauss's law to determine or characterize an electric field.
   6.6 Analyze charge distributions in conductors and nonconductors.
   6.7 Simplify series and parallel combinations of resistors or capacitors.
   6.8 Solve problems using Ohm's law.
   6.9 Apply Kirchhoff's laws to analyze DC circuits.
   6.10 Determine the power dissipated through one or more elements of a DC circuit.
   6.11 Relate the resistance of a conductor to its geometry and resistivity.
   6.12 Analyze problems involving the direction and magnitude of the magnetic force acting on moving charges (e.g., mass spectrometer).

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6.13 Apply the laws of electromagnetic induction (i.e., Faraday's law, Lenz's law).
6.14 Analyze problems involving AC circuits (e.g., transformers, peak current, root-mean-square voltage, frequency, reactance, resonant frequency, impedance).
6.15 Identify principles and components involved in the operation of motors and generators.
6.16 Predict the magnetic fields associated with current-carrying conductors (e.g., long straight wires, loops, solenoids).

**National Science Teachers Association Standards (NSTA)**

1. Understand and can successfully convey to students the major concepts, principles, theories, laws and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association. (NSTA 1.0a)
2. Use multiple assessment tools and strategies to achieve important goals for instruction that are aligned with methods of instruction and needs of students. (NSTA 8.0a)
3. Reflect constantly upon their teaching and identify ways and means through which they may grow professionally. (NSTA 10.0b)

**Professional Organization/Learned Society Standards**

National Society of Science Teachers Association; American Association of Physics Teachers
Florida Teacher Certification Examination (FTCE) Subject Area Examination (SAE) Competencies and Skills
American Physics Society (APS)
National Society of Black Physicists (NSBP)

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### Academic Learning Compact

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Behavioral objectives</th>
<th>INTASC Standards</th>
<th>NSTA For Teachers of Physics</th>
<th>FEAPs</th>
<th>FTCE SAE</th>
<th>PEU Conceptual Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experiment # 1</strong>&lt;br&gt;Determination of the Charge of an Electron</td>
<td>Students will:&lt;br&gt;1. Understanding of physics through personal experimental investigation.&lt;br&gt;2. Demonstrate knowledge and application of statistical analysis of experimental data&lt;br&gt;3. Demonstrate skills in presenting experimental results and analysis attaining a grade of 80% or higher&lt;br&gt;4. Demonstrate skills of writing a scientific report to present the results and analysis of the experiments attaining a grade of 70% or higher.</td>
<td>1.11, 4.11, 4.23</td>
<td>1C.5.a: 8.0, 9.0; 1C.5.b: 17.0, 18.0</td>
<td>1 4.1;&lt;br&gt;4.a,4.b, 4.k;&lt;br&gt;8.1:8.a,8.b,&lt;br&gt;12.1:12.1</td>
<td>1.2; 1.3;&lt;br&gt;2.1; 2.4 - 2.8;&lt;br&gt;6.1 – 6.16</td>
<td>CF: 2.1(S), 4.1(K), 5.1(K)</td>
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<tr>
<td><strong>Experiment # 2</strong>&lt;br&gt;Mapping of Electric Fields</td>
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<td><strong>Experiment # 3</strong>&lt;br&gt;Ohm’s Law</td>
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<td><strong>Experiment # 4</strong>&lt;br&gt;Resistors in Parallel</td>
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<td><strong>Experiment # 5</strong>&lt;br&gt;Capacitance and Capacitor Transients</td>
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<td><strong>Experiment # 6</strong>&lt;br&gt;Magnetic Force Acting on a Current Carrying Wire</td>
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<td><strong>Experiment # 7</strong>&lt;br&gt;Experiments with Magnets</td>
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<td><strong>Experiment # 8</strong>&lt;br&gt;Introduction to the Oscilloscope</td>
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<td><strong>Experiment # 9</strong>&lt;br&gt;LRC Circuits</td>
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<td><strong>Experiment # 10</strong>&lt;br&gt;Reflection and Refraction of Light</td>
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<td><strong>Experiment # 11</strong>&lt;br&gt;Thin Lenses</td>
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<td><strong>Experiment #12</strong>&lt;br&gt;Slit Diffraction</td>
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<td><strong>Experiment Presentation</strong></td>
<td>3. Demonstrate skills in presenting experimental results and analysis attaining a grade of 80% or higher&lt;br&gt;4. Demonstrate skills of writing a scientific report to present the results and analysis of the experiments attaining a grade of 70% or higher.</td>
<td>1.11, 4.11, 4.23</td>
<td>1C.5.a: 8.0, 9.0; 1C.5.b: 17.0, 18.0</td>
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<td>1.2; 1.3;&lt;br&gt;2.1; 2.4 - 2.8;&lt;br&gt;6.1 – 6.16</td>
<td>CF: 2.1(S), 4.1(K), 5.1(K)</td>
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F=Florida Educator Accomplished Practices Standards (FEAPS)<br>I=Interstate New Teacher Assessment and Support Consortium Standards (INTASC)<br>(K)=Knowledge  (S)=Skill  (D)=Disposition
Artifacts

<table>
<thead>
<tr>
<th>Standards</th>
<th>Name of the Artifact 1</th>
<th>Name of the Artifact 2</th>
<th>Name of the Artifact 3</th>
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<tr>
<td>PEU CF</td>
<td>Laboratory &amp; Report: Mapping of Electric Fields</td>
<td>Laboratory &amp; Report: Capacitance and Capacitor Transients</td>
<td>Laboratory &amp; Report: LRC Circuits</td>
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<td>FEA P</td>
<td>CF: 2.1(S), 4.1(K), 5.1(K)</td>
<td>CF: 2.1(S), 4.1(K), 5.1(K)</td>
<td>CF: 2.1(S), 4.1(K), 5.1(K)</td>
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<td>1.11, 4.11, 4.23</td>
<td>1.11, 4.11, 4.23</td>
<td>1.11, 4.11, 4.23</td>
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<tr>
<td>NSTA</td>
<td>1C.5.a: 9.0; 1C.5.b: 18.0</td>
<td>1C.5.a: 9.0; 1C.5.b: 18.0</td>
<td>1C.5.a: 9.0; 1C.5.b: 17.0</td>
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<td>FTCE SAE</td>
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<td>1.2, 1.3, 6.6; 6.7</td>
<td>1.2, 1.3, 6.13; 6.14</td>
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Topical Outline

- Week 1.2 No Class
- Week 3 Determination of the Charge on an Electron
- Week 4 Mapping of Electric Fields
- Week 5 Ohm’s Law
- Week 6 Resistors in Parallel
- Week 7 Capacitance and Capacitor Transients
- Week 8 Magnetic Force Acting on a Current Carrying Wire
- Week 9 Experiments with Magnets
- Week 10 Introduction to the Oscilloscope
- Week 11 LRC Circuits
- Week 12 Reflection and Refraction of Light
- Week 13 Thin Lenses
- Week 14 Slit Diffraction
- Week 15 Make up

Tentative Course Calendar

- Martin Luther King: --------------------------- 1/18
- Spring Break: -------------------------------- 3/8-11
- Last Day to Withdrawal: ---------------------- 3/26
- Last Day of Classes: ------------------------- 4/23
- Final Exam: --------------------------------- 4/26-30

Teaching Methods

F=Florida Educator Accomplished Practices Standards (FEAPS)
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Experiments illustrate the principles and concepts of physics taught in general physics I lecture. Each laboratory experiments is designed to give students experience in making measurements, gathering and interpreting data, manipulating certain laboratory equipment, and carrying out calculations studied in lecture.

**Course Evaluation**

Students will conduct 11 experiments with 1 introduction in Week 1 in a 12-week timeframe. Every week students will work in groups conducting the experiments and providing a lab report in the following week on that experiment and the data collected to be graded by the instructor.

Each experimental report must adhere to the following format:

I. Title page  
II. Experimental Objectives  
III. Theory  
IV. List of Materials and description of apparatus  
V. Experimental Procedures  
VI. Experimental Results  
VII. Conclusions  
VIII. Questions

Additionally, short 10 - 15 min written quizzes will be done in class to test student’s knowledge for each week’s lab prepared from the lab manual. A final exam will be conducted that will test the cumulative physics content of that complete 12-week period to be given during final exams week after the last week of classes in form of a 2-hour written exam in class.

**Grading**

11 experiments (each experiments is 10 points )--------------------------100 points (the lowest grade will be dropped)

<table>
<thead>
<tr>
<th>Experiment #</th>
<th>Description</th>
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<tbody>
<tr>
<td>EXPERIMENT # 1</td>
<td>Determination of the Charge on an Electron by the Method of Electrolysis</td>
</tr>
<tr>
<td>EXPERIMENT # 2</td>
<td>Mapping of Electric Fields</td>
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<tr>
<td>EXPERIMENT # 3</td>
<td>Ohm's Law</td>
</tr>
<tr>
<td>EXPERIMENT # 4</td>
<td>Resistors in Series and Parallel</td>
</tr>
<tr>
<td>EXPERIMENT # 5</td>
<td>Capacitance and Capacitor Transients</td>
</tr>
<tr>
<td>EXPERIMENT # 6</td>
<td>Magnetic Force Acting on a Current Carrying Wire</td>
</tr>
<tr>
<td>EXPERIMENT # 7</td>
<td>Experiments with Magnets</td>
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<tr>
<td>EXPERIMENT # 8</td>
<td>Introduction to the Oscilloscope</td>
</tr>
<tr>
<td>EXPERIMENT # 9</td>
<td>LRC Circuit</td>
</tr>
<tr>
<td>EXPERIMENT # 10</td>
<td>Reflection and Refraction of Light</td>
</tr>
<tr>
<td>EXPERIMENT # 11</td>
<td>Thin Lenses</td>
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10 Quizzes ---------------------------------------------------------------10 points
1 Final exam -------------------------------------------------------------10 points

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Course grades will be determined using the grand total obtained with the following percentage weights:
1. Lab reports: 80%.
2. Quizzes: 10%
3. Final Exam: 10%.

Grading scale: 90–100% A, 80–89% B, 70–79% C, 60–69% D, <59% F.

**Course Policies**

Students are expected to come well prepared to perform the labs by thoroughly study the laboratory manual. Care should be exercise so no personal injuries or damage to equipment occur. Since some of the labs can be lengthy, students are expected to work as efficiently as possible. Since there can be many students in class, order must be maintained. The laboratory area must be straightened up at the end of the laboratory. No food, drink or gum is allowed in the laboratory. Any behavior or activity that the instructor determines to be inappropriate or disrupted will be result in penalties, ranging from reductions in grade to dismissal from the laboratory.

**Reference**