**Course Syllabus**

<table>
<thead>
<tr>
<th>Course Number:</th>
<th>PHY 3101</th>
<th>Course Title:</th>
<th>MODERN PHYSICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite(s):</td>
<td>PHY 2049 or PHY 2054</td>
<td>Course Credit:</td>
<td>3</td>
</tr>
<tr>
<td>College:</td>
<td>Arts and Science</td>
<td>Required Text(s):</td>
<td>MODERN PHYSICS , 4th Edition By Tipler</td>
</tr>
<tr>
<td>Department:</td>
<td>Physics</td>
<td>Supplies:</td>
<td>VHPS</td>
</tr>
<tr>
<td>Faculty Name:</td>
<td>Johnson, Lewis E.</td>
<td>Term and Year:</td>
<td>FALL 2010</td>
</tr>
<tr>
<td>Office Location:</td>
<td>Centennial Building 102</td>
<td>Place and Time:</td>
<td>11:00am-12:15pm TU TH Scholl of Business &amp; Industry Room 332</td>
</tr>
</tbody>
</table>

**Office Hours**

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday 9AM-10PM</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
</table>

**Course Description**

This is an advance physics course design to give students an understanding of modern physics principles and concepts such as: Special theory of relativity, particle aspects of electromagnetic radiation, physical optics, applications of old quantum theory, Schroedinger equation, and the hydrogen atom.

**Course Purpose**

The course is to help students and prospective teachers to

A. Extract information from physics text through analytic reading.
B. Calculate and interpret the results of various physics problems.
C. Solve real problems using modern physics principles.
D. Develop models of modern physics problems.
E. Collaborate effectively with team members.
F. Solve problems through skilled time management.
G. Recognize and apply principles in the main area of modern physics, including relativity, electromagnetic radiation, and quantum mechanics of hydrogen atom.

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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.

7. **Knowledge of modern physics**
   7.1 Analyze problems based on the energy of a photon (e.g., photoelectric effect, \( E = hf \)).
   7.2 Apply Einstein's theory of special relativity (e.g., light postulate, length contraction, time dilation).
   7.3 Apply Einstein's mass-energy equivalence (\( E = mc^2 \)).
   7.4 Determine the allowed energies of quantum atomic states or of transitions between such states.
   7.5 Compare the characteristics of alpha, beta, and gamma radiation.
   7.6 Predict outcomes of radioactive decay processes (e.g., balancing a nuclear equation).
   7.7 Calculate the age of a radioactive source, given data (e.g., half-life, activity, remaining mass, decayed fraction).
   7.8 Differentiate between fission and fusion processes and their applications.
   7.9 Analyze problems involving Heisenberg's uncertainty principle (e.g., momentum versus position, energy versus time).
   7.10 Differentiate between historical models of the atom (e.g., Thomson's plum pudding, Rutherford, Bohr, electron cloud).
   7.11 Identify characteristics of subatomic and elementary particles (e.g., protons, neutrons, electrons, photons, neutrinos, quarks, antiparticles).
   7.12 Distinguish between the four fundamental forces of nature in terms of the particles they act upon, the relative distances over which they act, and their relative strengths.
   7.13 Identify characteristics of the dual (i.e., wave and particle) nature of light and matter

**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)

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### 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)

### 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>Homework: Selected physics and mathematics problem from the textbook and additional instructor addendums. Each homework assignment will address course content and is aimed at development problem solving skills.</td>
<td>Students will 1. Demonstrate knowledge of the lecture material, and 2. Develop and enhance the skill of analytical analysis and problem solving</td>
<td>1.10, 4.10, 8.10</td>
<td>1C.5.b.:12.0 - 22.0</td>
<td>4.1: 4.a,4.b; 8.1:8.a,8b.</td>
<td>1.1; 1.4; 1.5; 2.1 -2.8; 7.1-7.13</td>
<td>CF: 4.1(K) 4.5(S), 5.1(K)</td>
</tr>
<tr>
<td>Exams: Three tests will cover the material of Chapters 1 -12. Test 4 (Final) covers the material of Chapters 13-16.</td>
<td>Students will demonstrate knowledge (Chapters 1-16) and problem solving skill attaining a grade of 70% or higher.</td>
<td>1.10, 4.10, 8.10</td>
<td>1C.5.b.:12.0 - 22.0</td>
<td>4.1: 4.a,4.b; 8.1:8.a,8b.</td>
<td>1.1; 1.4; 1.5; 2.1 -2.8; 7.1-7.13</td>
<td>CF: 4.1(K) 4.5(S), 5.1(K)</td>
</tr>
</tbody>
</table>

### Course 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>
</tr>
</thead>
<tbody>
<tr>
<td>PEU CF</td>
<td>Homework (10 problems) on Special Theory of Relativity</td>
<td>Homework (10 problems) on Quantum Mechanics in One Dimension</td>
<td>Homework (10 problems) on Lasers</td>
</tr>
<tr>
<td>FEAP</td>
<td>4.1: 4.a,4.b; 8.1:8.a,8b.</td>
<td>4.1: 4.a,4.b; 8.1:8.a,8b.</td>
<td>4.1: 4.a,4.b; 8.1:8.a,8b.</td>
</tr>
<tr>
<td>INTASC</td>
<td>1.10, 4.10, 8.10</td>
<td>1.10, 4.10, 8.10</td>
<td>1.10, 4.10, 8.10</td>
</tr>
<tr>
<td>NSTA For Teachers in Physics</td>
<td>1C.5.b: 15.0</td>
<td>1C.5.b: 15.0</td>
<td>1C.5.b: 17.0, 22.0</td>
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<tr>
<td>FTCE SAE</td>
<td>1.4; 2.1 -2.8;7.1 – 7.3</td>
<td>1.4; 2.1-2.8;7.4, 7.9 , 7.10</td>
<td>1.4; 2.1-2.8; 7.1, 7.6, 7.13</td>
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</tbody>
</table>

### Topical Outline

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Teaching Methods

Experiences to be provided in this course may include reading assignments in the textbook. During lecture physics theory and concepts will be explain with sample problems to reinforce the understanding of subject. Given the nature of the subject it is to student responsibility to attend class. Solving problems is vital part of learning physics, at the end of each chapter, problems will be assigned. All assignments will be due on the due date. A week after the assignments is given. Absolute no late assignments will be accepted.

Methods of Evaluations

The purpose of evaluating is to accurately reflect the extent to which the student has mastered the course content. Accordingly a variety of indicators will be used that included four tests ( drop one test in case student run into

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emergencies, or drop one the lowest test ), class attendance, more significant is mental presence, web-base Homework, class participation

**Homework Assignments:** Problems from each section of the text will assigned each class. Unless otherwise stated they will be due one week after being assigned. Each homework assignment will address course content and is aimed at increasing your problem solving skills.

**Class Participation and Student Led Discussions:** Participation in class will be monitored and counts towards each student's grade.

**Course Examinations/ Final Examination:** There will be four (4) in-class Tests and a Final Exams. These tests and the final exam will be given to assess your content knowledge on major concepts, principles, and physical laws. The final exam will be cumulative.

4 TEST ( each of 20 points)------------------- 60 points (Drop the lowest one )

<table>
<thead>
<tr>
<th>Test #1</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Relativity</td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td>The Quantum Theory of Light</td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td>The Particle Nature of Light</td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td>Matter Waves</td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Test #2</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Week 5,6</td>
<td>Quantum Mechanics in One Dimension</td>
<td></td>
</tr>
<tr>
<td>Week 7,8</td>
<td>Tunneling Phenomena</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Test #3</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 9,10</td>
<td>Quantum in Three Dimensions</td>
<td></td>
</tr>
<tr>
<td>Week 11,12</td>
<td>Atomic Structure</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test #4</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Week 13,14</td>
<td>laser</td>
<td></td>
</tr>
<tr>
<td>Week 15,16</td>
<td>Hydrogen Atom</td>
<td></td>
</tr>
</tbody>
</table>

- 10 Homework ---------------------------------------------------- 10 points

| Homework # 1      | Relativity                |                           |
| Homework # 2      | The Quantum Theory of Light |                           |
| Homework # 3      | The Particle Nature of Light |                         |
| Homework # 4      | Matter Waves              |                           |
| Homework # 5      | Quantum Mechanics in One Dimension |                       |
| Homework # 6      | Tunneling Phenomena       |                           |
| Homework # 7      | Quantum in Three Dimensions |                         |
| Homework # 8      | Atomic Structure          |                           |
| Homework # 9      | laser                     |                           |
| Homework # 10     | Hydrogen Atom             |                           |

Final Exam ( 30 points ) ---------------------------------- 30 points

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Total                                      100 points

**Grading**

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100 - 90 = A  
98 - 80 = B  
79 – 70 = C  
69 – 60 = D  
< 59 = F

**Course Policies**

**ATTENDANCE:**
Given the nature of the subject it is to student responsibility to attend class. Each Student is expected to be prepared. Prepared means have text and any supplemental reading distributed, Ready to listen because “if you are not listening you are not learning”.

**WITHDRAWAL FROM CLASS WITHOUT PENALTY OF “F”:**
To withdraw from class, you must fill out and return in to the records office a drop form on or prior the midterm date listed on the front of the syllabus. If you stop coming to class without going to the proper withdrawal procedure will result in the assignment of a grade of “F“ for the semester.

**ASSIGNMENT OF AN INCOMPLETE “I”:**
An “I” will be assigned only to students, who fail to complete the course due to illness, Injury or other non-academic emergency. Only those students who were doing satisfactory work will be eligible for the “I” grade. An “I” must be satisfactorily removed during the following academic quarter or the symbol “I” will be changed to “F” by the Records office. In unusual circumstances, an instructor may extend an incomplete beyond the one-quarter deadline – not to exceed a total of three consecutive calendar quarters. In order to remove an “I”, student will not be permitted to re-register for the course.

Please contact me if you should have extended illness or some other unavoidable non-academic emergencies.

**ACADEMIC DISHONESTY:**
Cheating may consist of stealing someone else’s answer on an exam to using notes of a “crib” sheet during exam. Should cheating be detected you will receive a zero on the given exam. Plagiarism may consist by presenting the work of others as your own work. Same as cheating, it will be penalized with a zero on the assignment.

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