

CORE CURRICULUM COMPONENT APPLICATION
Sam Houston State University

PART I – Course Information

Course Type

☒ Existing/Restructured

☐ New Course Proposed

If new, have you submitted a Form B to the SHSU Curriculum Committee? ☐ Yes ☐ No

Course Prefix & Number: PHYS 1422

Course Title: Introduction to Physics II

Course Catalog Description (Copy and paste from online catalog for existing courses):

An introduction to the general topics of electricity and magnetism, and basic electrical circuits. The emphasis continues to be on problem solving with the laboratory/problem session an integral part of the course. Prerequisite: PHYS 1411 and MATH 1430 with a C or better. Credit 4.

Course Prerequisites: PHYS 1411, MATH 1430

Available Online? ☐ Yes ☒ No ☐ Anticipated (Semester:)

Number of Sections to be Offered per Year: 2 (This will be increased as needed to keep pace with new degree requirements by the Departments of Computer Science and Engineering Technology.)

Estimated Enrollment per Section: 20

Course Level (freshman, sophomore): Sophomore

Requestor Full Name (designated department rep – contact person): Joel Walker

E-Mail Address: jwalker@shsu.edu

Approvals

Department Chair:

Signature

Date

5/7/18

Academic Dean:

Signature

Date

5/7/18

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PART II – THECB Foundational Component Areas

See [Appendix](#) for full description of each component area.

Select Component Area: III. Life and Physical Sciences

How Component Area Addressed: Introduction to Physics II covers fundamental laws of nature related to the electric and magnetic forces. The theory of electricity and magnetism is of fundamental importance to physics, engineering, and applied science. This theory was formulated in its present form by James Clerk Maxwell, and through the Maxwellian perspective, students learn to describe, explain, and predict the phenomena in the natural world and how the physical world impacts human experience. In so doing, students learn methods of logical problem solving and the application of mathematics to the description of physical processes. The topics and problem-solving skills taught in the course provide tools for predicting and relating complex natural phenomena based upon a small core of basic principles. This course is the nationally standardized calculus-based second term physics course for students of engineering, physics, and other natural sciences. As such, it addresses the learning outcomes identified in the Spring, 2018 Lower-Division Academic Course Guide Manual developed by the THECB (hereinafter referred to as the ACGM) for College Physics II lecture and lab. *Examples of some of these outcomes are identified, when specifically referenced, in the discussion below.

The required skill objectives for this component area are critical thinking, communication, empirical and quantitative skills, and teamwork. Physics is an empirical and quantitative science. These skills are important in almost every part of the course. In solving physics problems, data are provided, and students must determine where to start the problem, devise a route to solve the problem, execute their solution, and examine whether their solution solves the problem and makes sense - all essential aspects of critical thinking. In addition, students must be able to communicate their answer, justify the approach taken and the validity of their answer. In the laboratory portion, students will work in teams on all laboratory experiments.

PART III – Course Objectives

Insert the appropriate course objectives stated in student learning outcomes (e.g., Students completing the course will be able to...)

Objective 1: The student will be able to apply mathematics to the description of physical processes, and establish the connection from theoretical and computational predictions to experimental outcomes. The ability to solve mathematical problems related to the course content correspond to Learning Outcomes 1, 3, 4, 5 in the ACGM.

How will requirement be addressed (including strategies and techniques)?

Electrical forces and fields are fundamental tools to understand physical systems. As such, the concepts are considered extensively in lectures with many examples, worked in a variety of situations, throughout the semester. This approach to understanding is reinforced by homework problems as well as laboratory experiments. For example, the application and solution of

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mathematical equations for the behavior of electrical circuits via Kirchhoff's laws will be demonstrated and compared to results in the laboratory, using boards with resistors, capacitors, and inductors, along with voltage and current meters. The application of Kirchhoff's laws correspond to Learning Outcome 2 in the ACGM.

Describe how requirement will be assessed: As is the norm, graded homework assignments and exams will be given in the lecture portion of the course, and graded laboratory assignments will also serve as a basis for assessment of student understanding. The lab assignments will allow for calculation of predicted outcomes, in a guided, sequential, manner, with form-based entries in the associated lab manual. Data will be collected and inferences will be drawn from the data, which may be compared to predictions. Students will critically evaluate the level of agreement, and any mitigating causes of potential disagreement. Required elements will include careful observation, computation of dependent quantities, analysis of trends in data, and quantification of limitations in the precision of equipment and/or statistical fluctuations.

Objective 2: The student will be able to articulate the fundamental concepts of electricity and electromagnetism, including electrostatic potential energy, electrostatic potential, potential difference, magnetic field, induction, and Maxwell's Laws (Learning Outcomes 3, 4, and 5 in the ACGM). Students will also apply these laws to the analysis of circuits with potential sources, capacitance, and resistance, including parallel and series capacitance and resistance. These laws are the basis of electrical engineering and thus demonstrate the implications of scientific principles for the physical world and human experience.

How will requirement be addressed (including strategies and techniques)?

The application of electromagnetic laws to electrical circuit problems is a fundamental technique to understand electronic devices and is described, quantified, and demonstrated in lectures throughout the semester. This approach is reinforced by homework problems, as well as laboratory exercises, in which the application and solution of problems with charges, currents, and time-dependent electromagnetic fields will be demonstrated.

Describe how requirement will be assessed: Immediate understanding will be probed by query and response during instruction to provide real-time informal assessment, and immediate feedback. Comprehension will be tested with online homework assignments, which provide real-time feedback and directed problem-solving hints. Standard exams will be given in lecture, and pre- and post-test responses to questions from standardized assessment instruments will be compared.

Objective 3: Students will be able to use Faraday's and Lenz's laws to determine the magnitude of electromotive forces. More broadly, students will learn how symbolic mathematical proofs are used to derive theorems governing the behavior of physical objects. (This ability corresponds to Learning Outcome 5 in the ACGM). Systems as varied as alternators in cars and metal detectors are based on Faraday's and Lenz's laws. These laws thus influence the physical world and human experience.

How will requirement be addressed (including strategies and techniques)?

The interdependence of Maxwell's equations will be taught, such as the relation of Gauss' law to Coulomb's law, and the relation of Faraday's law of induction to the Lorentz force. These and other electromagnetic laws are clearly explained with many examples in lectures. The laws are reinforced by online homework problems, which provide real-time feedback, as well as laboratory experiments and demonstrations.

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Describe how requirement will be assessed: Discussion in class will be used to assess comprehension as material is taught, with adjustments based upon student responses. Applications in problem solving will be tested with online homework assignments, which provide real-time feedback and directed hints, which help to guide the student toward a correct understanding of the principles and mathematics involved in solving the problems. The lab assignments will be graded, as will exams given in the lecture portion of the course.

Objective 4: Students will develop analysis skills valued in the workplace, such as mathematical sophistication, quick adaptation, trained intuition, capacity for abstraction, and ability to independently and creatively solve problems. This will be done by teaching students to articulate and apply the abstract, fundamental concepts of electricity and electromagnetism, including electrostatic potential energy, electrostatic potential, potential difference, magnetic field, induction and Maxwell's Laws. As regards the human experience component of the course content, students will learn that, without an understanding of Maxwell's laws, we would not have cell phones or, on a more abstract level, the standard model of particle physics. Thus, the concepts in this objective are critically important both for engineering and fundamental physics.

How will requirement be addressed (including strategies and techniques)?

The application of the fundamental concepts of electricity and electromagnetism are universal principles to understand the world. They are clearly elucidated with many examples in lectures. Most importantly, students work many problems as well as perform laboratory experiments involving these concepts. Solution of problems in the abstract will be modeled, without substitution of specific numbers, so that the solution remains applicable to all cases. It will be emphasized that "problem solving" means deriving an applicable formula from basic principles, rather than merely inserting numbers into a pre-existing formula. Various limiting cases and secondary manipulations of derived formulas will be studied, for example, application of the electric field solution above a ring of charge to derive the corresponding solution for a disk of charge (calculus application), and evaluation of the result as the disk radius goes to infinity. Expectations for physical behavior will be anticipated prior to mathematical derivation of formulas, for example, by thinking about what forces might apply to a conducting ring that is passed through a region of magnetic field (the principle of inductive electrical generation) before introducing a calculation.

Describe how requirement will be assessed: Inquiry methods will be applied, asking students to visualize and report on familiar physical scenarios, such as the behavior of magnetic N/S poles. Students will work along with the professor in class at their own desks, implementing modeled techniques. Immediate responses will be evaluated and corrected in real time, for example in a dialog regarding time dependence of the charge and current flow in a resistive-capacitive circuit. Expectations for physical outcomes will be polled prior to demonstration of formal solutions, and misconceptions will be subsequently redirected and corrected. These non-quantitative forms of formative assessment will be balanced by summative assessments which include homework assignments, lab reports, and exams, all of which will be graded.

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Objective 5: Students will be able to conduct basic laboratory experiments involving electricity and magnetism and relate physical observations and measurements involving electricity and magnetism to theoretical principles. The laboratory experience gives the students the opportunity to directly observe the phenomena learned in lectures. By doing these things, students will develop an understanding of the role of electrodynamics as a foundation of modern physics, including its connection to relativity and theoretical particle physics.

How will requirement be addressed (including strategies and techniques)?

During the laboratory exercise, students will actively make measurements and learn through experience. In the lab reports, students describe, discuss, and quantify their observations, and critically examine sources of error. In lecture, the frame-dependence of process interpretations and the frame-independence of physical predictions will be discussed and their mathematical derivation will be demonstrated. In addition, the foundation of the electromagnetic theory as a "gauge invariant and relativistically covariant" structure will be described/mathematically demonstrated.

Describe how requirement will be assessed: Conceptual understanding will be assessed in real-time with discussion and student polling using a "response system". Conceptual exam questions will be designed to probe comprehension and intuition for topics such as the "role" played by various Maxwell equations, and the perceptions of observers in different states of motion relative to an experiment. Students will report on their progress in understanding basic laws and principles of the subject in an end-of-semester course evaluation. These non-quantitative forms of formative assessment will be used in conjunction with summative assessments which include homework assignments, lab reports, and exams, all of which will be graded.

PART IV – THECB Skill Objectives

Address each of the required THECB skill objectives that the course addresses and explain how the requirement is addressed, specific strategies to address the objective(s), and how each objective will be assessed. **Address ALL skill objectives associated with the selected Component Area. (See Appendix)**

1. Critical Thinking Skills: to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information

How will requirement be addressed (including strategies and techniques)?

Problem solving requires critical thinking and occurs in every lecture. It is reinforced through numerous homework problems, the hour exams, and a comprehensive final. The word problems, which are used extensively, require the ability to determine the relevant information needed to solve the problem and the creative manipulation and application of basic formulas to solve them. This is a multi-step process wherein data are provided, students determine where to start the problem, devise a route to solve it, and execute its solution. This is always followed by an examination of the the solution to determine if it makes physical sense. Accordingly, through the use of numerous examples worked in class throughout the semester, this process is modeled, each step of which entails essential aspects of critical thinking. This method, also used in the proposed PHYS 1411 course, is reinforced through numerous homework problems, the hour exams and a comprehensive final. In the lab, the students perform hands-on activities,

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compare measurements to theory and critically examine sources of experimental and modelling error. Word problems requiring the creative manipulation and application of basic formulas will be solved.

Describe how requirement will be assessed: Immediate understanding will be probed by query and response during instruction. Comprehension will be tested with online homework assignments, which provide real-time feedback and directed problem-solving hints. Pre- and post-test responses to questions from standardized assessment instruments such as the Force Concept Inventory will be compared. Exams also include these types of problems, which require critical thinking to solve.

2. Communication Skills: to include effective development, interpretation and expression of ideas through written, oral and visual communication

How will requirement be addressed (including strategies and techniques)?

Written and Visual Communication: In order to address written and visual communications skills, students will write an artifact on a physics research topic, and a rubric will be provided to provide guidance as to how to write the artifact. Appropriate visual elements (e.g. graphs, images) will be included in the paper to foster the development of improved visual communication skills. For the lab component of the course, students will also attend a physics research colloquium and will be required to write a research essay on the same topic (including supplemental sourced reading) intended for a general audience.

In addition the formal writing assignments, students are required to answer exam questions and laboratory exercises by written response, the quality of which affects the grade received.

Oral and Aural Communication: Students work with partners in the lab, so they must communicate effectively to successfully complete the laboratory reports. In addition, classroom work will involve extensive dialog with students, establishing and correcting their expectations for physical and mathematical outcomes. The class size is small enough that students are encouraged to ask questions during lecture and the lecturer engages students by asking them questions during the lecture. This helps to enhance their oral communication skills.

Describe how requirement will be assessed: The writing artifact and research colloquium paper will be peer- and instructor-reviewed using the rubric that was provided to students when the artifacts were assigned. The rubrics will consist of the following components: (1) scientific accuracy; (2) completeness of coverage; (3) effectiveness of communication; (4) quality of writing including grammar, organization, development of ideas, etc.; and (5) quality of visual elements. Scores on each component will range from: (1) below expectations; (2) evolving; (3) proficient; (4) outstanding. Both the students and the lab assistant will use this rubric as a basis for assigning a grade.

The written exams and lab reports will be graded by the instructor or lab assistant, as appropriate.

As part of the teamwork evaluation (see below), team members will evaluate their team members' oral and aural communication skills using the teamwork rubric (as teamwork necessarily involves two-way communication).

3. Empirical and Quantitative Skills: to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions

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How will requirement be addressed (including strategies and techniques)?

Physics is based on empiricism and quantitative description/modeling of the physical world. Accordingly, quantitative skills are paramount in every part of the course. Quantitative problem solving strategies are taught and practiced. Practice includes homework problems, exams, and a comprehensive final exam. In the laboratory, students make quantitative measurements to establish observable facts, which they analyze and critically compare to theoretical models. Students are then able to make informed conclusions in regard to the validity of the model and the experimental procedure. As part of this overall process, laboratory measurements will be analyzed for evidence of the underlying physical laws.

Describe how requirement will be assessed: Comprehension will be tested with online homework assignments, which provide real-time feedback and directed problem-solving hints. Exams will require extensive quantitative analysis and problem solving. Pre- and post-test responses to questions from standardized assessment instruments will be compared. Laboratory sessions will include calculation of predicted outcomes, in a guided, sequential, manner, with form-based entries in the associated lab manual. Data will be collected and inferences will be drawn from the data, which may be compared to predictions. Students will critically evaluate the level of agreement, and any mitigating causes of potential disagreement. Pre- and post-test responses to questions from standardized assessment instruments such as the Force Concept Inventory will be compared.

4. Teamwork: to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal

How will requirement be addressed (including strategies and techniques)?

In the laboratory part of the course, students work in teams on the experiments. To be successful, they need to consider different points of view and to work effectively with others to set up experiments, collect data, and analyze and interpret their findings. In order to develop teamwork skills, information will be provided to students describing effective teamwork strategies, as well as common pitfalls when working in groups.

To encourage genuine participation by each member of the team, the students in a team will anonymously evaluate the contributions made by the other members of the team using a scale of 0-10. At the end of the semester, the average peer evaluation score for a group member will be used to determine the percentage of group points received by a team member. Accordingly, an average of 10 points equals 100%, an average of 9 equals 90%, and so on. For example, if the member receives an average of 10, he/she will receive 100% of the points earned by the team on the group assignments. If he/she receives an average of 9.2, then he/she will receive 92% of the group points, and so on.

Describe how requirement will be assessed: As described, the scores received by the peer-evaluation process are a reflection of both the collective efforts of a team, and the contribution by each member of the team. Higher scores reflect greater teamworking ability, both at the team level and at the individual level. In addition, laboratory assistants will monitor and supervise collaboration among groups and provide suggestions as to how to improve teamwork as needed. And, as stated previously, the rubric to evaluate teamwork will also include ratings of oral and aural communication proficiency.

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5. Personal Responsibility: to include the ability to connect choices, actions and consequences to ethical decision-making

How will requirement be addressed (including strategies and techniques)?

N/A

Describe how requirement will be assessed: N/A

6. Social Responsibility: to include intercultural competence, knowledge of civic responsibility, and the ability to engage effectively in regional, national, and global communities

How will requirement be addressed (including strategies and techniques)?

N/A

Describe how requirement will be assessed: N/A

PART V – SHSU Core Curriculum Committee Requirements

1. Using a 15-week class schedule, identify the topics to be covered during each week of the semester. Provide sufficient detail to allow readers to understand the scope and sequence of topics covered.

Week 1	Electric Charges and Coulomb's Law: static charge, attraction/repulsion, inverse square HRW CH21
Week 2	Electric Fields: vector components of fields, vector sums, vector superposition HRW CH22
Week 3	Electric Flux and Gauss' Law: flux, enclosed charge, solving for electric field HRW CH23
Week 4	Voltage and Electrical Potential Energy: volts, scalar superposition, energy conservation HRW CH24
Week 5	Capacitance: charge storage, series and parallel equivalent capacitors, charging time HRW CH25. Lab 1: Inductions and Circuit Boards
Week 6	Current and Ohm's Law: resistance, batteries, parallel and series equivalent resistors HRW CH26. Lab 2: Current and Ohm's Law
Week 7	Circuits and Kirchhoff's Laws: loop rules, voltage drops, current sums HRW CH27. Lab 3: Kirchhoff's Rules
Week 8	Magnetic Fields and the Lorentz Force: charge in motion, vector force, dipole magnets HRW CH28. Lab 4: Wheatstone Bridge
Week 9	Enclosed Current and Ampere's Law: loop geometries, solving for mag field, solenoids HRW CH29. Lab 5: Capacitors in Circuits
Week 10	Faraday's Law of Induction: changing magnetic fields, motors, generators HRW CH30. Lab 6: RC Circuit (Charging/Discharging)
Week 11	Maxwell's Equations: interrelation and completeness of physical laws HRW CH32. Lab 7: LR Circuit (Inductance)
Week 12	Electromagnetic Waves: speed of light, wavelength, frequency, transverse waves HRW CH33. Lab 8: RLC Circuit (Oscillation)
Week 13	Interference and Diffraction: single and double slit experiments, thin films HRW CH35/36. Lab 9: Optics with Mirrors
Week 14	Lenses and Ray Optics: concave and convex lenses and mirrors, magnification HRW CH34. Lab 10: Optics with Lenses

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Week 15	Special Relativity: time dilation, length contraction, invariant proper time HRW CH37
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2. Attach course syllabus

Syllabus Attached? ☒ Yes ☐ No

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Appendix: THECB Component Area Descriptions and Skill Requirements

I. Communication (Courses in this category focus on developing ideas and expressing them clearly, considering the effect of the message, fostering understanding, and building the skills needed to communicate persuasively. Courses involve the command of oral, aural, written, and visual literacy skills that enable people to exchange messages appropriate to the subject, occasion, and audience.)

II. Mathematics (Courses in this category focus on quantitative literacy in logic, patterns, and relationships. Courses involve the understanding of key mathematical concepts and the application of appropriate quantitative tools to everyday experience.)

III. Life and Physical Sciences (Courses in this category focus on describing, explaining, and predicting natural phenomena using the scientific method. Courses involve the understanding of interactions among natural phenomena and the implications of scientific principles on the physical world and on human experiences.)

IV. Language, Philosophy, and Culture (Courses in this category focus on how ideas, values, beliefs, and other aspects of culture express and affect human experience. Courses involve the exploration of ideas that foster aesthetic and intellectual creation in order to understand the human condition across cultures.)

V. Creative Arts (Courses in this category focus on the appreciation and analysis of creative artifacts and works of the human imagination. Courses involve the synthesis and interpretation of artistic expression and enable critical, creative, and innovative communication about works of art.)

VI. American History (Courses in this category focus on the consideration of past events and ideas relative to the United States, with the option of including Texas History for a portion of this component area. Courses involve the interaction among individuals, communities, states, the nation, and the world, considering how these interactions have contributed to the development of the United States and its global role.)

VII. Government/ Political Science (Courses in this category focus on consideration of the Constitution of the United States and the constitutions of the states, with special emphasis on that of Texas. Courses involve the analysis of governmental institutions, political behavior, civic engagement, and their political and philosophical foundations.)

VIII. Social and Behavioral Sciences (Courses in this category focus on the application of empirical and scientific methods that contribute to the understanding of what makes us human. Courses involve the exploration of behavior and interactions among individuals, groups, institutions, and events, examining their impact on the individual, society, and culture.)

Required Skill Objectives

Foundational Component Areas	CT	COM	EQS	TW	SR	PR
Communication	✓	✓		✓		✓
Mathematics	✓	✓	✓			
Life and Physical Sciences	✓	✓	✓	✓		
Language, Philosophy & Culture	✓	✓			✓	✓
Creative Arts	✓	✓		✓	✓	
American History	✓	✓			✓	✓
Government/Political Science	✓	✓			✓	✓
Social and Behavioral Sciences	✓	✓	✓		✓	

COURSE SYLLABUS

PHYS 1422 – Introduction to Physics II

Credit Hours: 4

Fall / Spring 20XX

Farrington Building, Room 209

XX:00 – XX:50 MWF

Laboratory: F209

Instructor:	Name
Phone:	(936) 294-XXXX
Main Physics Office:	(936) 294-1601
Email:	name@shsu.edu
Office:	Farrington, room XXX XX-XX or by appointment

Course Description:	An introduction to the general topics of electricity and magnetism, and basic electrical circuits. The emphasis continues to be on problem solving with the laboratory/problem session an integral part of the course. Writing Enhanced. Prerequisites: PHYS 1411 and MATH 1430 (may be taken concurrently with department approval). Credit 4.
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Course Goals:	This course is designed to develop basic competencies in the unified subject of electricity and magnetism. Techniques will be developed for the analysis of problems dealing with electric charges and currents, the electric and magnetic fields which they produce, and engineering applications to resistors, capacitors, and inductors in circuits. All of classical electro-magnetic theory can be described using only the four “Maxwell” field equations in combination with the “Lorentz Force” law. We will study each of the basic phenomena that comprise the theory, and also convey understanding and intuition of their greater unified structure, which is related to consistency with special relativity, preceding (and motivating) Einstein’s formal theory by nearly three decades. We will see that rules of electrodynamics are not an à la carte list of imposed conditions, but rather the unique, cohesive and unavoidable consequence of very fundamental truths of nature. Beyond just the application of stock formulae to problems, each student must master the techniques of deriving equations applicable to special cases from more fundamental principles. Success in this course will not be achieved by rote memorization, or absorption of facts. Rather, the student must become adept at logical reasoning and creative problem solving.
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Objectives:

1. Students will be able to apply mathematics to the description of physical processes, and establish the connection from theoretical and computational predictions to experimental outcomes.
2. Students will be able to articulate the fundamental concepts of electricity and electromagnetism, including electrostatic potential energy, electrostatic potential, potential difference, magnetic field, induction, and Maxwell's Laws. Students will also apply these laws to the analysis of circuits with potential sources, capacitance, and resistance, including parallel and series capacitance and resistance.
3. Students will be able to use Faraday's and Lenz's laws to determine the magnitude of electromotive forces. More broadly, students will learn how symbolic mathematical proofs are used to derive theorems governing the behavior of physical objects.
4. Students will develop analysis skills valued in the workplace, such as mathematical sophistication, quick adaptation, trained intuition, capacity for abstraction, and ability to independently and creatively solve problems.
5. Students will be able to conduct basic laboratory experiments involving electricity and magnetism and relate physical observations and measurements involving electricity and magnetism to theoretical principles.
6. Students will develop their critical thinking skills through the development of problem-solving skills, and the analysis and interpretation of data associated with lab experiments
7. Students will learn to identify potential sources of error in experimental design and measurement.
8. Students will develop the written and visual communication skills through written assignments and reports.
9. Students will develop their teamwork skills, and the associated oral and aural communication skills associated with teamwork involved with laboratory activities.
10. Students will develop their empirical and quantitative skills through assignments involving problem solving and by conducting laboratory experiments.

Required Textbook:

Fundamentals of Physics, 10th Edition
by Halliday, Resnick & Walker (Vol II or Combined)

Required Supplies:

A calculator with trigonometric functions is essential for this course. Graphing calculators are allowed, but not required. In all testing situations, your calculator may be utilized for standard arithmetic and trigonometric computation only. The use of internal memory for storage of notes is strictly and expressly prohibited.

Assignments:

Homework assignments will be given for each chapter covered in the course.

Regular, personal application of the concepts encountered is essential to mastery of the required material. Furthermore, these problems will be a valuable insight into what material is considered important by your instructor. Careful completion of all assignments is in itself an effective way to boost your course average. Moreover, failure to participate will almost certainly damage your test and quiz performance.

Exams:

3-4 major examinations will be given during the semester, in addition to a comprehensive final. If a special situation exists which would cause you to miss an exam, this **MUST** be made known to me prior to the date of the test if possible. Otherwise, a makeup will be allowed in only the **MOST EXCEPTIONAL** situations, evaluated on a case-to-case basis.

Grading Plan:

The Laboratory, recitation, and homework are each worth 10%. The semester exams together will comprise 50% of your grade. It is intended that your confidence and ability will grow tremendously during the course of the semester. The comprehensive final is your chance to show how far you have come, and makes up 20% of the full semester average.

Class Rules:

All class members are expected to respect the proceedings of this course, and the learning environment of their fellow students. This principle has several practical implications, some of which are enumerated below.

- 1) Do not cheat. Violators are subject to dismissal on a 1st offence.
- 2) Regular punctual attendance is expected of all class members.
- 3) There is to be absolutely no use of Cellular phones in the classroom, for either voice or text communication. Parents of young children and professionals who may reasonably expect some chance of an emergency contact should silence their phones, and discreetly excuse themselves if it becomes necessary to take a call. All others should turn their phones off entirely.

Email Guidelines:

Email communication with your instructor should be made in a professional manner. Instant-Message style notes are not acceptable in a business or academic setting. All email should employ the standard features listed following.

- 1) Include your name, course number and class meeting time.
- 2) Include a proper salutation, body and closing.
- 3) Make a reasonable attempt at correct grammar, capitalization, punctuation, and spelling.

Week-by-Week Schedule

PHYS 1422 is the standard second semester calculus-based course in physics offered by universities around the world to continuing physics and engineering majors, as well as the students of several other natural science disciplines. The list of topics taught in this course is very well standardized. The following schedule, which provides a rough sequential summary of the expected coverage, is subject to revision at discretion of the instructor.

Week 1	Electric Charges and Coulomb's Law: static charge, attraction/repulsion, inverse square HRW CH21.
Week 2	Electric Fields: vector components of fields, vector sums, vector superposition HRW CH22.
Week 3	Electric Flux and Gauss' Law: flux, enclosed charge, solving for electric field HRW CH23
Week 4	Voltage and Electrical Potential Energy: volts, scalar superposition, energy conservation HRW CH24
Week 5	Capacitance: charge storage, series and parallel equivalent capacitors, charging time HRW CH25. Lab 1: Inductions and Circuit Boards
Week 6	Current and Ohm's Law: resistance, batteries, parallel and series equivalent resistors HRW CH26. Lab 2: Current and Ohm's Law
Week 7	Circuits and Kirchhoff's Laws: loop rules, voltage drops, current sums HRW CH27. Lab 3: Kirchhoff's Rules
Week	Magnetic Fields and the Lorentz Force: charge in motion, vector force, dipole magnets HRW CH28. Lab 4: Wheatstone Bridge
Week 9	Enclosed Current and Ampere's Law: loop geometries, solving for mag field, solenoids HRW CH29. Lab 5: Capacitors in Circuits
Week 10	Faraday's Law of Induction: changing magnetic fields, motors, generators HRW CH30. Lab 6: RC Circuit (Charging/Discharging)
Week 11	Maxwell's Equations: interrelation and completeness of physical laws HRW CH32. Lab 7: LR Circuit (Inductance)
Week 12	Electromagnetic Waves: speed of light, wavelength, frequency, transverse waves HRW CH33. Lab 8: RLC Circuit (Oscillation)
Week 13	Interference and Diffraction: single and double slit experiments, thin films HRW CH35/36. Lab 9: Optics with Mirrors

Week 14	Lenses and Ray Optics: concave and convex lenses and mirrors, magnification HRW CH34. Lab 10: Optics with Lenses
Week 15	Special Relativity: time dilation, length contraction, invariant proper time HRW CH37

Tips for Success:

This is likely to be one of the more demanding courses you encounter during your college career. It can also be rewarding and enjoyable. Several suggestions for a good start are printed here.

- 1) Make sure that you are proficient in the mathematical prerequisites. Mathematics is the essential language used to concisely and precisely state the content of physical law. You must be able to speak the language in order to proceed in the course. We will make extensive use of algebra, trigonometry and calculus. We will assume a functioning knowledge of these subjects, but will review advanced topics as needed with detailed example solutions.
- 2) Attend class regularly and take effective notes. It is certainly the case that I will focus class time on the concepts and materials which I deem most valuable, beneficial and instructive. It stands to reason that the same material will form the core of what will subsequently be tested.
- 3) Focus on Ideas and Concepts, not Memory. This course is fundamentally different in design than most you have probably taken prior. Retention of facts alone will not suffice. Success will come instead from the skillful application of the tools and logical thought processes developed. We will employ only short list of equations. Your job will be to correctly understand how, when, and why each equation applies in context.
- 4) Complete all required homework, and attempt problems individually. Regular, personal application of the concepts encountered is the only way to go beyond understanding someone else's solution, and develop confidence in your own problem solving skills. There is simply no substitute here for the experience gained by long practice. Assignments will be given for each course chapter. These will be collected and assigned a grade. Failure to participate will also certainly damage your test and quiz performance. Additionally, these problems can give valuable insight into the material favored by your instructor.
- 5) Seek out help. It is certainly important to persevere through, and even focus your attention especially toward the problems which you have greatest difficulty in solving. However, repeated application of misunderstood tools and indefinite lockdown on a single issue are also damaging and discouraging. Study partners who are also enrolled in physics 1411 can be very beneficial for comparing and correctly completing homework. It is good strategy for each member to first attempt all problems alone prior to such meetings, or to intersperse private and group work during the meeting. Office hours are also available for your benefit, and groups are especially welcome. Additionally, the SPS offers free tutoring a few nights a week, later into the semester.
- 6) Don't give up. Don't fall into a destructive cycle where frustration

blocks participation in the class and related activities. At exams, focus first on the things you know - then fight for each remaining point, never dismissing entire problems at a glance. It may take some time to learn the required way of thinking. However, it can sometimes finally “click” like a light switch, and a struggling student can rapidly shift from doing almost nothing correctly, to almost everything.

- 7) Worry less about your grade, and more about developing understanding. If you are dedicated to absorbing and taking ownership of the material, your grade will take care of itself.

Standard University Policies

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USE OF TELEPHONES AND TEXT MESSAGERS IN ACADEMIC CLASSROOMS AND FACILITIES: The use by students of electronic devices that perform the function of a telephone or text messenger during class-time may be prohibited if deemed disruptive by the instructor to the conduct of the class. Arrangements for handling potential emergency situations may be granted at the discretion of the instructor. Failure to comply with the instructor's policy could result in expulsion from the classroom or with multiple offenses, failure of the course. Any use of a telephone or text messenger or any device that performs these functions during a test period is prohibited. These devices should not be present during a test or should be stored securely in such a way that they cannot be seen or used by the student. Even the visible presence of such a device during the test period will result in a zero for that test. Use of these devices during a test is considered de facto evidence of cheating and could result in a charge of academic dishonesty. <http://www.shsu.edu/students/guide/StudentGuidelines2010-2012.pdf#page=29>

LABORATORY SYLLABUS

PHYS 1422 – Introduction to Physics

Credit Hours: 1

Lab Instructor: _____ (fill in name and email for future reference)

Email: _____

Physics Office: (936) 294-1601
Office Location: Farrington, room XXX

Required Textbook: Physics 1422 Lab Manual (available at Bookstore)

Required Supplies: Pencils, Notebook, and a calculator with trigonometric functions.

Description and Goals: The PHYS 1422 Laboratory is designed to complement and enhance your classroom experience. It begins a few weeks after the start of the semester. A single grade is assigned for both components as a whole, with a contribution of 15% from the laboratory. Many concepts discussed in a theoretical or problem-solving context during the main course will be experienced and tested here by firsthand contact. Engineering-related topics will tend to be emphasized, because of their applied nature. You will begin to develop the careful observational skills required for scientific lab work, and learn to correctly glean useful information and generalizations from those results. You will practice techniques for the reduction of systematic observing errors, and learn to properly account for the manner in which unavoidable random or statistical errors limit the applicability of your conclusions. You will practice effective communication of your procedure, observations, and conclusions by the completion of a lab report template for each session.

Objectives:

1. Students will be able to apply mathematics to the description of physical processes, and establish the connection from theoretical and computational predictions to experimental outcomes.
2. Students will be able to articulate the fundamental concepts of electricity and electromagnetism, including electrostatic potential energy, electrostatic potential, potential difference, magnetic field, induction, and Maxwell's Laws. Students will also apply these laws to the analysis of circuits with potential sources, capacitance, and resistance, including parallel and series capacitance and resistance.

3. Students will be able to use Faraday's and Lenz's laws to determine the magnitude of electromotive forces. More broadly, students will learn how symbolic mathematical proofs are used to derive theorems governing the behavior of physical objects.
4. Students will develop analysis skills valued in the workplace, such as mathematical sophistication, quick adaptation, trained intuition, capacity for abstraction, and ability to independently and creatively solve problems.
5. Students will be able to conduct basic laboratory experiments involving electricity and magnetism and relate physical observations and measurements involving electricity and magnetism to theoretical principles.
6. Students will develop their critical thinking skills through the development of problem-solving skills, and the analysis and interpretation of data associated with lab experiments
7. Students will learn to identify potential sources of error in experimental design and measurement.
8. Students will develop the written and visual communication skills through written assignments and reports.
9. Students will develop their teamwork skills, and the associated oral and aural communication skills associated with teamwork involved with laboratory activities.
10. Students will develop their empirical and quantitative skills through assignments involving problem solving and by conducting laboratory experiments.

Teamwork:

Students work on experiments in teams (groups of 3-4). To be successful, they need to consider different points of view and to work effectively with others to collect data and analyze and interpret their findings. To encourage genuine participation by each member of the team, the students in a team will *anonymously* evaluate the contributions made by the other members of their team using a scale of 0-10. This will include an evaluation of the each team member's verbal (oral) and listening (aural) communication skills. At the end of the semester, the average peer evaluation score for a group member will be used to determine the percentage of group points received by a team member. Accordingly, an average of 10 points equals 100%, an average of 90 equals 90%, and so on. For example,

if the member receives an average of 10, he/she will receive 100% of the points earned by the team on the group assignments. If he/she receives an average of 9.2, then he/she will receive 92% of the group points, and so on. The teamwork score will count as half of the laboratory grade.

Lab Reports:

Half of your semester lab grade will be determined by the completion and quality of your written responses to the structured laboratory manual. All assigned team members receive the *same* score, but each group member must participate in every step, completing their own lab report, filling in all data, making all computations, and answering all questions. Structured report templates with blanks for responses are at the rear of your manual, and should be removed for completion. The reports from each member of a team must be bundled together and handed in as a set at the end of the lab meeting. The preliminary questions must be completed *individually* prior to the start of each lab, and will be initialed by your instructor – failure to effectively prepare for the lab by completion of these questions will be reflected in the teamwork scores assigned by your group. It is intended that each team should work cooperatively to collect all data, and perform essential calculations. Open-ended discussion questions are asked to test your ability to draw conclusions from the interpretation of your laboratory experience. Each individual should demonstrate independent contributions to the answering of these thought questions, comparing and learning from the responses of their peers. All assertions must follow in a direct and logically consistent manner from the actual content of your own experiment. If you feel that some procedural error has clouded your results, then this may be discussed.

Attendance:

Attendance is mandatory for each laboratory meeting. One makeup lab is made available at the end of the semester *in case of an excused absence*. The laboratory TA will keep track of attendance and deduct 10% from each student's combined laboratory grade for absences which are not made up. No student should leave any lab meeting prior to handing in their report (as part of the group's set of reports) and being excused by their instructor.

Writing Assignment:

A special lab component will require students to attend a physics research colloquium and also write a research essay on the same topic (including supplemental sourced reading) intended for a general audience. Students will each peer-review 3-4 sample essays, and report on a rubric assessing components (1. scientific accuracy; 2. completeness of coverage; 3. effectiveness of communication; 4. quality of writing); 5. quality of visual elements as (1. below expectations; 2. evolving; 3. proficient; 4. outstanding). Both the students and the lab assistant will use this rubric to assign a grade.

The collected artifacts will be used for University assessment of student development in writing.

Grading:

Teamwork: 30% of the grade
Lab assignment reports: 60% of the grade
Writing Assignment: 10% of the grade

Lab Schedule:

Ten exercises will be selected for completion from the 1422 lab manual. The schedule example shown following is subject to revision by your laboratory coordinator.

Week 1	Introduction to Circuits Board
Week 2	Current and Ohm's Law
Week 3	Kirchhoff's Rules
Week 4	Wheatstone Bridge
Week 5	Capacitors in Circuits
Week 6	RC Circuit (Charging/Discharging)
Week 7	LR Circuit (Inductance) Writing assignment due
Week 8	RLC Circuit (Oscillation)
Week 9	Optics with Mirrors
Week 10	Optics with Lenses

Role of Lab Instructor:

Your lab TA's role is to facilitate the efficient and productive operation of the lab meeting. Although the lab is designed to work in tandem with your main course, the distinct objectives of each setting will cause certain subjects to be emphasized more or less strongly, or sometimes to be presented in a different order. Your TA will open each meeting with a sufficiently detailed introduction or review to keep that day's material self-contained. During operation of the lab, the TA is available to aid in setup, clarify procedures, and provide general assistance. However, they will not serve as a reference of packaged answers. The lab TA has no responsibility to meet with students outside of scheduled meeting times. If disputes arise, the student should first attempt a direct resolution with their TA. If this becomes impossible, or if external mediation is required, the matter should be brought to the lab supervisor.

Please keep in mind the fact that your TA is also an undergraduate student at SHSU. They are learning how to perform their job better even as they are working to help you; this experience is as unique and important a part of their education as it is of yours. Your respect and patience are vital to the success of this effort!

Class Rules:

All class members are expected to respect the proceedings of this course, and the learning environment of their fellow students. This principle has several practical implications, some of which are enumerated below.

- 1) Do not cheat. Violators are subject to dismissal on a 1st offence.
- 2) Regular punctual attendance is expected of all class members.
- 3) There is to be absolutely no use of Cellular phones in the classroom, for either voice or text communication. Parents of young children and professionals who may reasonably expect some chance of an emergency contact should silence their phones, and discreetly excuse themselves if it becomes necessary to take a call. All others should turn their phones off entirely.

Email Guidelines:

Email communication with your instructor should be made in a professional manner. Instant-Message style notes are not acceptable in a business or academic setting. All email should employ the standard features listed following.

- 1) Include your name, course number, and class meeting time.
- 2) Include a proper salutation, body and closing.
- 3) Make a reasonable attempt at correct grammar, capitalization, punctuation, and spelling.

Criteria for Evaluating Teamwork

When evaluating anything, including teamwork, it is essential to have in mind the criteria by which it will be evaluated. Using the criteria helps to maintain objectivity and fairness – as well as consistency among those doing the evaluations. You will anonymously assign each team member a score of 0-10 based on their contributions to the group effort. Note that the laboratory TA will separately keep track of attendance, so your score should reflect participation for dates the group member was present. *If it helps to arrive at a score, you can assign points on a 0-10 scale for each of the relevant items below and then average them.*

1. Did the team member come prepared? Had he or she read the background material?
2. Did the team member engage in the discussion and offer suggestions for consideration?
3. Was it evident that the team member had reasonable knowledge of the main topics?
4. Was the team member polite and courteous, or rude and disrespectful?
5. Did the team member pay attention and stay focused, or did he or she disengage, act bored, etc.?
6. Did the team member attempt to communicate effectively with other members of the team as regards suggestions and explanations offered during lab activities?
7. Was the team member effective at communicating with other members of the team as regards suggestions and explanations offered during lab activities?

8. Did the team member listen to what other members of the team were saying and respond as appropriate? For example, if a suggestion was made as to how to solve a problem, did the team member acknowledge the suggestion and respond accordingly?

As regards assignments that required meeting outside of class time:

9. Did the team member come to meetings on time?
10. Did the team member notify the group if he or she was unable to come and provide a reasonable excuse for not attending?
11. Did the team member submit his or her portion of the work on time?
12. Was work submitted by the team member accurate/useful /appropriate?
13. Did the individual participate in proof-reading and evaluating the written assignment that was submitted for the group score?

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