COURSE SYLLABUS

PHYS 4368 – Electricity and Magnetism
Credit Hours: 3
Fall 2017

Farrington Building, Room 105
9:00 – 9:50 MWF

Instructor:	**Dr. James B. Dent**
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Office hours: **Farrington, room 216 B** 2-3 MW, 1pm on F, or by appointment

Catalog Description: Properties of dielectrics and magnetic materials, electromagnetic fields, and Maxwell's equations are studied. Prerequisite: MATH 3376. Credit 3.

This course is designed to develop advanced competencies in the unified subject of electricity and magnetism, extending techniques of problem analysis developed in PHYS 1422. Electromagnetism is not only a beautiful and well tested physical theory, it also maintains a dominant presence in the functioning of modern technology. The description of classical electromagnetic theory can be formulated in a wonderfully compact way using only four field equations known as "Maxwell's 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. Electrodynamics (and its quantum version, quantum electrodynamics (QED)) serves as a template for other field theory models, and helps form the basis for all of modern particle physics. The ideas and techniques encountered in its study will be visited repeatedly in other areas of physics.

A retrospective analysis of Maxwell's equations reveals that they form a logically closed group representation of "local $U(1)$ gauge-invariance", and therefore will give the student their first encounter with the ideas of gauges and groups which are integral to a wide array of physics models. Moreover, Maxwell's equations contain the hidden signatures of special relativity, which preceded (and motivated) Einstein's formal theory by nearly three decades. The key point to be emphasized is that the rules of electrodynamics are not an à la carte list of imposed conditions, but rather the unique, cohesive and unavoidable consequence of fundamental descriptions of nature.

We will review the basic tools first taught in your introductory coursework, and extend them with a more general mathematical framework which enables investigations of increasingly detailed phenomena. We will also attempt to bolster a comprehensive understanding of where

these techniques and tools come from, taking a "first principles" approach to the motivation, intuition and quantitative structure of each problem encountered.

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. The course will be computationally intensive, with the methods of vector calculus employed throughout in the solution of problems, and the proof of intermediate steps. A wide variety of assignments will be given from the required textbook by Griffiths.

Required Textbook: Introduction to Electrodynamics, 4th Edition,
David J. Griffiths (978-0321856562)

Required Supplies: A calculator with trigonometric functions is essential. Graphing calculators are allowed and preferred, 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 regularly throughout the course duration. Dedicated, 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 a critical component of your course average. Moreover, failure to participate will almost certainly damage your exam performance.

Exams: Three major examinations will be given during the semester (number is subject to reevaluation) 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.

Grading Plan: Homework will be worth 25%. The three semester exams together will comprise 55% of your grade. The comprehensive final 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 no use of Cellular phones or other internet connected devices in the classroom, for either voice or text communication. Please discreetly excuse yourself if it becomes necessary to take a call.

Standard University Policies

The following are university-wide official policies which apply to this course. Additional details are available at the web address: **http://www.shsu.edu/syllabus/**

Academic Dishonesty: Students are expected to maintain honesty and integrity in the academic experiences both in and out of the classroom.

Classroom Rules of Conduct: Students are expected to assist in maintaining a classroom environment that is conducive to learning. Students are to treat faculty and students with respect. Students are to turn off all cell phones while in the classroom. Under no circumstances are cell phones or any electronic devices to be used or seen during times of examination. Students may tape record lectures provided they do not disturb other students in the process.

Student Absences on Religious Holy Days: Students are allowed to miss class and other required activities, including examinations, for the observance of a religious holy day, including travel for that purpose. Students remain responsible for all work.

STUDENTS WITH DISABILITIES POLICY: It is the policy of Sam Houston State University that individuals otherwise qualified shall not be excluded, solely by reason of their disability, from participation in any academic program of the university. Further, they shall not be denied the benefits of these programs nor shall they be subjected to discrimination. Students with disabilities that might affect their academic performance should register with the Office of Services for Students with Disabilities located in the Lee Drain Annex (telephone 936-294-3512, TDD 936-294-3786, and e-mail disability@shsu.edu). They should then make arrangements with their individual instructors so that appropriate strategies can be considered and helpful procedures can be developed to ensure that participation and achievement opportunities are not impaired.

SHSU adheres to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations for students with disabilities. If you have a disability that may affect adversely your work in this class, then I encourage you to register with the SHSU Services for Students with Disabilities and to talk with me about how I can best help you. All disclosures of disabilities will be kept strictly confidential. NOTE: No accommodation can be made until you register with the Services for Students with Disabilities. For a complete listing of the university policy, see: http://www.shsu.edu/dotAsset/7ff819c3-39f3-491d-b688-db5a330ced92.pdf

Visitors in the Classroom: Only registered students may attend class. Exceptions can be made on a case-by-case basis by the professor. In all cases, visitors must not present a disruption to the class by their attendance. Students wishing to audit a class must apply to do so through the Registrar's Office.

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 messager 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 messager 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. See: http://www.shsu.edu/students/guide/StudentGuidelines2013-2016.pdf