

PHYSICS 2421: Fields & Waves for Physics Majors
Fall 2014

This course is another critical part of the foundation of your future physics understanding. An understanding of electricity and magnetism, not only provides you with great insight into real life experiences (static electricity, car electrical systems, home electricity, electronic devices, magnets, etc.), but it provides you with a tremendously important theoretical construct: the field. The basic understanding of electric and magnetic fields that you will develop in this class, will be the physical foundation for a much deeper understanding of fields that you will obtain when you take higher level mathematics (MATH 3335) and learn concepts such as gradient, divergence and curl. With these mathematical tools you will revisit electricity & magnetism in PHYS 4341. Note also, the field concept (and related mathematics) applies to gravitational fields as well. If you work hard in this course, it will be time well spent!

Instructor: Dr. Rajendra Zope; rzope@utep.edu Office: PSCI 116
Office Hours: Will be announced in class or by an appointment

Textbook: University Physics, Young & Friedman, 13th Edition, Chapters 21-29, with selections from Chapters 30, 31 & 32 (See below). 12th edition OK.

Laboratory: To be provided

Homework: We will be using MasteringPhysics for homework (<http://www.pearsonmylabandmastering.com/northamerica/masteringphysics/index.html>). It seems to get an access code you have to pay \$66, and you can purchase the electronic copy of book along with code for \$110. Verify at masteringphysics.com.

Exams: Closed book. Will include both conceptual and problem solving type questions

Grading: 20% Final Exam (cumulative with emphasis on most recent):
30% Exams: Three exams during the semester.

10% Quizzes (lowest grade dropped)
20% Lab
20% Homework: to be submitted through MasteringPhysics or on paper when asked.
(The percentage indicated will be roughly (not exactly) as above).

Learning Goals

This semester you will be learning about the *amazing* world of electricity and magnetism and it all revolves around the physical property known as “charge.” A simple way to think about everything you will learn in this course is that you will learn about 1) stationary charges, 2) flowing charges (moving together with more or less constant velocity), and 3) accelerating charges.

First: Stationary Charges. Charges exert forces upon one another (allowing you to use PHYS 2420). The ability of a lone, stationary charge to exert a force if another charge were placed near it, is the basis for the concept of the “electric field”. Thinking about charges doing work upon one another is the basis for the concept of “electric potential,” known less accurately as “voltage.”

Second: Flowing Charges. When voltages cause electrons to move in conductors, one can design “electrical circuits.” The basic understanding of circuits you will develop in PHYS 2421 will lead to critical practical knowledge of real-life circuits in your car, your home, and your stereo. It turns out that electrical currents give rise to “magnetic fields,” identical to those caused by permanent magnets made out of iron! This leads to a practical understanding of electromagnets, such as those that ring a door bell, operate the solenoid in your car that pulls the starter against the fly wheel, or operates the solenoid valves in a dish washer or washing machine.

Third: Accelerating Charges. When you accelerate charges you create time-varying electric and magnetic fields that move through space (even empty space!). This moving, time-varying, electric and magnetic field is more commonly known as an “electromagnetic wave.” While we will not have much time to dig into electromagnetic waves, note that this concept explains radio waves, microwaves, infrared radiation, visible light, ultraviolet light, x-rays, and gamma rays!

Missed Exam

Make up exams will only be considered if you have a signed letter from your medical doctor or other appropriate authority. These letters must be verifiable. Contact information must be provided and when the appropriate individual is contacted, they will need to be able to corroborate the absence. If the letter cannot be verified, the case will be turned over to the Dean of Students as being suspected of Academic Dishonesty.

Students with Disabilities

If you have a disability (physical or psychological) and require reasonable accommodations to enable you to participate in this course (such as note takers, readers, or extended time on exams and assignments) please contact your lecture instructor as soon as possible and provide the appropriate documentation from Disabled Student Services (747-5148 or dss@utep.edu). Without this documentation, no accommodations will be made. Please take care of this before the first exam.

UTEP Policies on Academic Dishonesty

If an instructor suspects a student of cheating, he/she is to collect evidence that he/she believes indicates this (e.g. exams, student work, etc). This evidence is then turned over to the Assistant Dean of Students (ADS). The student will receive an incomplete on whatever piece of work is under consideration. No other actions will be taken by the instructor until the case is closed: no discussion, no accusation, and no different treatment. The student is encouraged to continue participating in the class. The ADS will consider the evidence provided her and then contact the accused student (and possibly peers) and investigate the allegations. The ADS will then make a decision as to whether cheating occurred and determine what the consequences will be. The instructor will be consulted by the ADS as to whether the results of the

investigation are acceptable to him/her. If acceptable, the instructor will simply carry out the consequences sent to both the student in question and the instructor in a formal letter from the Dean of Students. While the seriousness of the identified dishonest actions determines the nature of the consequences, possible consequences include: a counted "zero" on the piece of work, a letter grade reduction, or being placed on academic probation. Students have the right to appeal a decision and participate in a formal public hearing.