Electricity and Magnetism

Physics 2220

Spring 2022

Lecture Section 004, TuTh 12:30–1:50 p.m. in Phys 104
Recitation sections: .216, .217

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Office Hours: M and Tu 11:00–Noon and by appointment. In person or via https://unt.zoom.us/j/86950745200?pwd=VFZ6TlVvYW5sV0VrOVZ5T3Bqdm5zZz09

Text: Recommended text is *University Physics,* 15th, 14th or 13th Edition, by Young and Freedman. You are req uired to obtain access to the Expert TA online homework system. Detailed instructions on accessing Expert TA are given at the end of the syllabus before the Addendum.

Other calculus-based physics texts are acceptable; **the successful student will have a text.**

Topics: This course will cover electric fields, direct-current and alternating-current circuits, magnetic fields and magnetic induction, electric and magnetic properties of matter, electromagnetic waves, and geometrical and wave optics.

Attendance and Participation: You are expected to attend and participate in all lectures and recitation sections **as long as you are healthy.** Lecture and recitation section may involve graded activities that cannot be made up if you are absent. If you are sick, let me know as soon as possible. **See the Addendum to Course Syllabus at the end of the syllabus for more information on COVID-19 impact on attendance and other class policies.**

Exams: There will be **three exams from 4:00-5:50 pm on Fridays at dates indicated on the lecture schedule**, and a comprehensive **final exam on Thursday, May 12 from 10:30 – 12:30 p.m.** Exam questions will involve both mathematical calculations and conceptual explanations and will be based on lecture material, and material contained in the text, recitations, and in the homework assignments. Questions pertaining to the grading of exams must be directed to the instructor in writing within one week of receiving your graded exam. If you miss an exam for a valid reason, you need to contact the instructor via email within 24 hours to make arrangements to take a different, make-up exam.

Learning From Mistakes: Learning necessarily involves making mistakes. If you never make mistakes then you are not being sufficiently challenged. The goal is to make most of your mistakes on the homework so the you can ask questions and review your notes/textbook to learn from those mistakes before you get to the exam. When you make a mistake on an exam, your goal is still to understand what you did wrong and to learn from that mistake. In order to make each exam both an assessment and a learning experience, each exam will consist of two parts: Part 1 will consist of 12-15 multiple choice questions that you must solve on your own. Part 2 will consist of 3-5 free response questions, very similar to select multiple choice questions from Part 1, for which you will be allowed to access your class notes and discuss the questions with classmates. Your exam score will be a weighted average of your scores on each part of the exam. Exam score = 0.75*(Part 1 score) + 0.25*(Part 2 score).

Homework: All homework will be posted and submitted online using Expert TA. You must access your assignments and submit your solutions by the due date indicated on the server. Expert TA allows 6 submission attempts for each problem with 3% deduction for each incorrect submission. Hints can be accessed with a 1% deduction for each accessed hint. Late homework is accepted up to two weeks after the due date with a rate of decrease in percentage of 5% per day, and a floor percentage for late work of **75%**.

Grades: The course grade will be based on the total points earned on exams, homework, and attendance/participation. The percentage values for each category are:

Exams	1st exam **16%**; 2nd exam **16%**; 3rd exam **16%**
Final Exam	**30%**
Homework	**17%**
Attendance/Participation	Lecture Attendance 3**%**, Recitation quizzes **2%**
Total	**100%**

Exams and the Final Exam will be curved.

Lab Credit: You must enroll separately in Physics 2240 for laboratory science credit.

Disability Accommodation: The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with an accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the Office of Disability Accommodation website at http://www.unt.edu/oda. You may also contact them by phone at 940.565.4323.

The University of North Texas is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 92-112 – The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitled Americans with Disabilities Act (ADA), pursuant to section 504 of the Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens.

UNT's policy on Academic Dishonesty is found at: https://vpaa.unt.edu/ss/integrity. Cheating, plagiarism or other forms of academic dishonesty on an exam may result in a grade of zero on the exam, or a reduction in course letter grade. Posting or sharing class assignments, activities, or exam questions outside the class or Canvas system is student misconduct and may lead to disciplinary action.

Core course objectives: In this course, students focus on describing, explaining, and predicting natural phenomena using the scientific method. Strong emphasis is placed on student understanding of interactions among natural phenomena and the implications of scientific principles on the physical world and on human experiences.

PHYS 2220 contributes the following core course learning objectives:
(1) **Critical thinking**
Students will gain the ability to use mathematics and the basic physical laws of nature to solve problems. This skill requires creative thinking to identify and apply appropriate models to analyze physical phenomena.
(2) **Effective communication**
Students will gain proficiency in communicating ideas effectively in graphical and written form through submission of examinations; and, in oral form through interactive question-answer problem-solving in the recitation sessions, and lecture discussion of concepts.
(3) **Quantitative skills**
Students will have extensive practice applying algebra, geometry, trigonometry, and differential and integral calculus in their analyses of physics problems.
(4) **Teamwork**
Students are encouraged to work the homework in small teams. This will require students to consider different points of view and work effectively with others.

Detailed Topics: This course will cover electric fields, direct-current and alternating-current circuits, magnetic fields and magnetic induction, electric and magnetic properties of matter, and electromagnetic waves. Students will learn how to:

- Calculate the electric field or potential of point charges and continuous charge distributions.
- Explain and apply Gauss's law.
- Calculate the magnetic field from continuous current distributions.
- Explain the meaning and application of the integral form of Maxwell's equations.
- Analyze simple AC and DC circuits involving resistors, capacitors and inductors.
- Compute the time constants for RC, RL and RLC circuits.

Physics 2220 Goals and Learning Strategies

The goals of instruction in Physics 2220 are to lead and guide you to understand and master the fundamentals of elementary electromagnetism, and to develop your skills of analysis using the mathematical tools of algebra and calculus. To help in achieving these goals you are advised to pursue the following strategies:

(1) **Read the textbook chapter within forty-eight hours prior to the class**. You should bring your questions to class or e-mail the instructor prior to the morning of the class.
(2) During class, **listen, observe, take notes, analyze, discuss with peers, answer questions, solve in-class problems and respond when asked**.
(3) **Summarize the main ideas from class,** aloud to a friend or in writing, within twenty-four hours after class.

(4) **Set your notes and textbook aside while working on homework.** Review your textbook/notes when you get stuck, but then set aside again and try to complete the homework on your own.
(5) **Respond via e-mail** or during office hours whenever you have a question that has not been answered in class.
(6) **Come to class prepared:** bring a calculator in order to participate and take full advantage of the lecture hall learning experience.
(7) **Work extra problems for practice,** such as from the textbook**.**

Tentative Lecture Schedule

Session	Date	Day	Chapter: Lecture Topic
1	18 Jan.	Tu	Ch. 21: Electric charges, fields and forces
2	20 Jan.	Th	Ch. 21: Coulomb's law, electric field lines
3	25 Jan.	Tu	Ch. 22: Electric flux, Gauss's law
4	27 Jan.	Th	Ch. 22: Applications of Gauss's law, conductors in electrostatic equilibrium
5	1 Feb.	Tu	Ch. 23: Electric potential energy, electric potential
6	3 Feb.	Th	Ch. 23: Electric field from potential, electric potential for continuous charge distributions
7	8 Feb.	Tu	Ch. 23: Electric potential continued, equipotential surfaces
8	10 Feb.	Th	Ch. 24: Capacitance, capacitor networks
9	15 Feb.	Tu	Ch. 24: Capacitor networks, energy in capacitors, dielectrics
10	17 Feb.	Th	Ch. 25: Ohm's Law, resistors
Exam 1	**18 Feb.**	**Fr**	**Exam 1 - Chs. 21-24**
11	22 Feb.	Tu	Ch. 25: Resistors continued, power dissipation in resistors
12	24 Feb.	Th	Ch. 26: Resistor networks, Kirchhoff's rules
13	1 Mar.	Tu	Ch. 26: RC circuits, electrical safety
14	3 Mar.	Th	Ch. 27: Magnets and magnetic fields
15	8 Mar.	Tu	Ch. 27: Magnetic force on charged particles and wires
16	10 Mar.	Th	Ch. 27: Torque on current loops, motion of charged particles in magnetic fields, Hall effect
NA	*15 Mar.*	*Tu*	*Spring Break*
NA	*17 Mar.*	*Th*	*Spring Break*
17	22 Mar.	Tu	Ch. 28: Biot-Savart law, force between current-carrying conductors, Gauss's law for magnetism
18	24 Mar.	Th	Ch. 28: Ampere's law
Exam 2	**25 Mar.**	**Fr**	**Exam 2 - Chs. 25-28**
19	29 Mar.	Tu	Ch. 29: Faraday's law of induction, Lenz's law
20	31 Mar.	Th	Ch. 29: Applications of Faraday's law
21	5 Apr.	Tu	Ch. 30: Inductance, RL circuits, energy in magnetic fields
22	7 Apr.	Th	Ch. 30: RL, LC and RLC circuits
23	12 Apr.	Tu	Ch. 31: Phasors and Reactance
24	14 Apr.	Th	Ch. 31: Phasors and Reactance (continued)
25	19 Apr.	Tu	Ch. 31: Power in AC circuits, transformers
26	21 Apr.	Th	Ch. 32: Maxwell's Equations, electromagnetic spectrum
Exam 3	**22 Apr.**	**Fr**	**Exam 3 - Chs. 29-32**
27	26 Apr.	Tu	Ch. 32: Poynting vector, energy and momentum in electromagnetic waves
28	28 Apr.	Th	Ch. 32: Energy and momentum in electromagnetic waves (continued)

29	3 Apr.	Tu	Review
30	5 Apr.	Th	Review
Final Exam	**12 May**	**Th**	**Final Exam—Comprehensive (10:30 a.m. – 12:30 p.m.)**

Homework Information

In this course you will be using Expert TA, an online tutorial and homework program.
To get started:

(a) Go to the registration link:
Class Registration - PHYS 2220.004 (Spring 2022) w/ Dr. Barr $32.50
Student Registration Link: http://goeta.link/USQ45TX-BD9F2A-2RM
(b) Enter your email address (to be your user name), a password, and requested personal information
(c) Either use your access card from the bookstore, or pay using a credit card.

You can now begin using Expert TA. You will be directed to the main class management screen and your class name will be in the left column under "Classes". Assignments will be in the middle column listed under "Assignments" and are shown by due date/time. Note, tutorial problems are available for practice throughout the semester in the "Student Practice Area". These are unsaved assignments you can create yourself without the pressure of grade, and include some extra guidance.

There is a "Getting Started with Expert TA" Tutorial available, so you can get familiar with the interface. Hints and Feedback should be used often when available, as these are key features of the system.

Student & Tech Support – email main@theexpertta.com any time. You can also call 24x7 toll-free 877-572-0734. Student FAQs are available by visiting http://theexpertta.com/support/support-faqs.

Ancillary Materials

Canvas will be used to post useful course materials and your grades. You will find an electronic copy of the syllabus and copies of Power Point presentations from the lectures on Canvas.

A **Help Room** on the second floor of the Physics Building (Physics Instructional Center room) is staffed weekdays by tutors to assist you with questions regarding homework assignments; their schedules will be posted on Canvas. TA contact information will also be posted on Canvas.

Course Evaluation

The Student Perceptions of Teaching (SPOT) is a requirement for all organized classes at UNT. This short survey will be made available to you on-line at the end of the semester and will provide you with an opportunity to provide feedback to your course instructor. SPOT is considered to be an important part of your participation in this class.

After logging in to the my.unt.edu portal, students can access the SPOT survey site by clicking on the SPOT icon. A list of their currently enrolled courses will appear. Students complete each course evaluation independently. During the long terms, the SPOT is open for students to complete two weeks prior to final exams. During the summer terms, the SPOT is open for students to complete six days preceding their final exam.

Note to Members of TAMS

The Texas Academy of Mathematics and Science (TAMS) administration has made the followings statement and has asked us to include it in our syllabus for members of the Academy:

Class attendance and participation is required. Students must be alert, attentive, energetic, and eager to learn. Students who exhibit disruptive behavior or show disrespect to a teacher in the classroom are subject to severe disciplinary sanctions. The Academy does not authorize absences from class. Students must report all absences to the Academic Office within 36 hours of the absence by completing a form in the Academic Office. A student will be assessed 5 disciplinary points for each class absence, unless the absence can be justified. Faculty will also be reporting absences to the Academic Office. A student will be assessed 15 disciplinary points for failure to report an absence that is reported by a faculty member.

If you are a TAMS student and if you are absent for any reason, you are required to file an absence report with the TAMS Academic Office in Marquis Hall 134.

Addendum to Course Syllabus

COVID-19 Impact on Attendance
While attendance is expected as outlined in the syllabus, it is important for all of us to be mindful of the health and safety of everyone in our community, especially given concerns about COVID-19. Please contact me if you are unable to attend class because you are ill, or due to a related issue regarding COVID-19. It is important that you communicate with me prior to being absent so I can excuse you from class.

If you are experiencing any symptoms of COVID-19 (https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html) please seek medical attention from the Student Health and Wellness Center (940-565-2333 or askSHWC@unt.edu) or your health care provider PRIOR to coming to campus. UNT also requires you to contact COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure. While attendance is an important part of succeeding in this class, your own health, and those of others in the community, are more important.

Vaccine and Testing Availability
Vaccinations and Booster shots are available at **no out-of-pocket cost** at the Student Health and Wellness Center. Rapid antigen and PCR tests are also available on campus at various locations. See the UNT Coronavirus Updates Page (https://healthalerts.unt.edu/) for the latest recommendations and information about resources available on campus.

In the event that classes are forced to move online, the information below will apply:

Class Materials for Remote Instruction
Students will need access to a webcam, microphone and computer capable of running Zoom and the Respondus lock-down browser in Canvas. Information on how to be successful in a remote learning environment can be found at https://online.unt.edu/learn.

Server Unavailability and other Technical Difficulties
The University is committed to providing a reliable online course system to all users. However, in the event of any unexpected server outage or any unusual technical difficulty which prevents students from completing a time sensitive assessment activity, the instructor will extend the time windows and provide an appropriate accommodation based on the situation. Students should immediately report any problems to the instructor and contact the UNT Student Help Desk: helpdesk@unt.edu or 940.565.2324 and obtain a ticket number. The instructor and the UNT Student Help Desk will work with the student to resolve any issues at the earliest possible time.

Class Recordings & Student Likenesses
Synchronous (live) Zoom sessions in this course will be recorded for students enrolled in this class section to refer to throughout the semester. Class recordings are the intellectual property of the university or instructor and are reserved for use only by students in this class and only for educational purposes. Students may not post or otherwise share the recordings outside the class, or outside the Canvas Learning Management System, in any form. Failing to follow this restriction is a violation of the UNT Code of Student Conduct and could lead to disciplinary action.