

PHYSICS 421

Electricity & Magnetism

Physics 421 is an in-depth treatment of electricity and magnetism. It involves problem solving with an emphasis on physics problems that require integral calculus.

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Textbook: University Physics Volume 2 from OpenStax, ISBN 193816816X
(www.openstax.org/details/university-physics-volume-2)

Prerequisite: MATH 401 and PHYS 410 with grades of "C" or better

Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300;
OR ESLR 340 AND ELSW 340.

Course Website: Canvas: <https://canvas.losrios.edu>

Course Topics:

week 1	electric charge, conductors & insulators, electric force
week 2	electric force & fields
week 3	motion of charges in electric fields, electric flux Gauss's Law, symmetry
week 4	electric potential energy, electric potential
week 5	connecting potential & field, capacitance/capacitors, energy in capacitors
week 6	exam 1 ; current, resistance, resistivity
week 7	resistors, Ohm's Law, resistors in circuits, electric power
week 8	electromotive force, dc circuit analysis, Kirchoff's rules, RC circuits
week 9	magnets, magnetic fields & forces
week 10	exam 2 ; charges moving in magnetic fields, magnetic force on a wire
week 11	torque on a coil, Biot-Savart Law, Ampere's Law
week 12	magnetic flux, EMI, Faraday's & Lenz's Laws, self induction, inductors
week 13	energy in inductors, inductors in circuits; <i>Thanksgiving</i>
week 14	mutual inductance, transformers, ac circuit analysis
week 15	RL, RC & LRC ac circuits, resonance, power
week 16	Maxwell's Equations, electromagnetic waves
week 17	<i>finals week</i>

Final Exam: Tuesday, Dec. 18, 3:00 –5:00 pm

Course Evaluation:

Your grade in this course is a combination of homework, laboratory work, in-class activities, and exams. The points for each are listed here:

Midterm Exams	There will be 2 midterm exams, worth 250 points each.	500
Final Exam	The final exam is worth 300 points.	300
Homework	There are 24 homework assignments, worth 10 points each.	240
Lab Activities	There are 14 lab activities, worth 10-25 points each.	245
Other Assignments	There are 3 other assignments, with 5 points each.	15

Total: 1300

In general, your letter grade will be assigned using the following scale:

1170 – 1300 points	A
1040 – 1169 points	B
910 – 1039 points	C
780 – 909 points	D
less than 780 points	F

HOWEVER, if you fail to complete all the required work, (turn in homework only once in a while, skip labs, come to class only once in a while, leave early, etc...), then your letter grade will be determined by the instructor based on an evaluation of your overall performance in class.

This is a college-level course, so you are expected to be in class on time, work hard, ask questions, participate in the class, be responsible for your own work, present all your work in a professional manner, keep high ethical standards, do your own work without copying from others, and behave as an adult with both your instructor and classmates.

Student Learning Outcomes:

Upon successful completion of this course, you will be able to:

- test the validity of a hypothesis using the scientific method.
- identify the basic physical principles that apply in a particular situation (such as Coulomb's law, Ohm's law, and charge conservation).
- evaluate conceptual problems requiring the application of electricity and magnetism.
- solve problems requiring the application of physics and mathematics up through calculus.
- interpret the results of physics calculations.
- define basic physics terms and physical laws.
- compose a well-organized and complete lab report.

PHYS 421 General Information

Keys to Success:

- Attend every class. This course covers a lot of material very quickly. You cannot afford to miss a single day of class.
- Study everyday, not just on the weekends. The class moves very fast. Do not fall behind!
- Do all of the homework. Start working on homework as soon as it is assigned.
- Do not give up if you do not understand a concept or how to solve a particular problem. Ask questions, either in class or during office hours.
- Study with friends. Form study groups to help each other clarify and organize the material. Do not fall in the trap, however, of just copying somebody else's work.
- Concentrate on understanding concepts rather than memorizing formulas. Concentrate on setting up a problem rather than on getting an exact numerical answer.

The Importance of Communication:

In this class, you will be evaluated on your ability to:

1. understand the questions I ask you,
2. determine the appropriate answers to those questions, and
3. communicate your answers in a clear and concise manner.

The last point is very important, but often overlooked. You cannot demonstrate that you understand a question and can answer it correctly if you do not communicate your answer clearly. This applies to in-class discussion, homework, labs, and exams.

Guidelines for Handing in Homework:

1. **Clearly identify the problem** being answered, and write up the solutions in the order the problems were assigned.
2. **Make a diagram** to illustrate the situation. This is the best way to understand what the problem is asking before trying to solve it. In the diagram, label the known quantities and assign a symbol to the unknowns.
3. **Show all your work**. Be reasonably detailed. Explain your reasoning. Clearly state any assumptions made in the problem or in the formulas. For some of the problems assigned you can verify the answer in the back of the book. Note: the main purpose of the homework is to see how you set up and solve the problem, not to show just final answer. **No credit will be given for homework problems that only report an answer with no process shown.** (The same will be true in exams, so practice here first!) And, partial credit will be given if you follow the correct process but fail to get the correct answer at the end.
4. A complete numerical calculation must follow at least these four steps:
 - Step 1: Write the appropriate formula(s), in symbols.
 - Step 2: Solve for the unknown before putting any numbers in.
 - Step 3: Put the numbers into the formula, with units. You many need to convert numbers to the correct SI units before you put them in.
 - Step 4: Report the answer, with units and correct significant figures.Points will be deducted if you skip any of these steps.
5. Write in neat, legible print. **Messy homework will not be graded.**

General Information:

- This class uses Canvas (<https://canvas.losrios.edu>) as a class website. Announcements, assignments, handouts, homework examples, and grades will be posted to the Canvas website.
- Cell phones and other electronic devices must be turned off and put away during class. Points will be deducted from your grade if your cell phone rings during class or if you are seen using your cell phone during class, especially during an exam.
- Any students requiring accommodation for disabilities should contact me during the first few days of class so there is sufficient time to make the necessary arrangements.
- There are a number of campus resources available to help you succeed in this class.

LRC: The Learning Resource Center is a well-equipped, professionally staffed facility that offers students a personal approach to academic success through independent study, individualized tutoring, and alternate modes of instruction.

ARC STEM Center: The ARC STEM Center (formerly called MESA) is a learning community for students pursuing four-year degrees in the fields of mathematics, science, or engineering. The STEM Center helps students achieve in the classroom, progress academically, and develop professionally.

DSPS: Disabled Students Programs and Services provides specialized services and academic accommodations to meet the needs of students with disabilities.

Science Success Center: Work at your own pace on modules designed to help you improve your skills in note taking, paraphrasing, graphics reading, concept mapping, test preparation and test taking for science classes.

- This class is math and language intensive. You will use algebra, trigonometry, geometry, and calculus to solve problems on a regular basis. You will also be expected to read and understand questions written in technical English, and communicate in English with your fellow classmates and your instructor. If your math skills or English language skills are not up to speed then you will not succeed in this class, and you should consider taking the appropriate courses to prepare yourself for this challenging course.

PHYS 421 Attendance Policy

Daily Attendance:

Attendance and participation are required. If you know you are going to miss class on a particular day, arrange with the professor to make up the missed work ahead of time.

Athletes may miss a regular class to attend an athletic event if they bring a note from their coach and arrange to make up the work ahead of time. However, athletes may not miss an exam to attend an athletic event.

Since everyone has an occasional issue arise that causes them to miss class, you are allowed up to two absences throughout the semester. More than two absences may result in the lowering of your grade at the end of the semester. More than three absences may result in you being dropped from the class.

There are no make-up opportunities for in-class activities. If you are absent during a lab, you will receive no credit for that activity even if you have a valid excuse for your absence.

Exam Attendance:

You are responsible to be in class on time and ready to go on exam days. Showing up late or missing an exam will affect your grade significantly. Plan ahead on exam days. Expect bad traffic. Expect to find no parking on campus. Get to campus early and show up to class early to get settled before the exam starts.

If you miss an exam, contact the professor on the same day to arrange a make-up time. Do not wait until next class to tell the instructor you missed the exam and want to make it up. Make-up exams are not guaranteed, even if you have a valid excuse.

Tardiness:

Class starts on time. You are expected to show up sufficiently early to be in your seat and ready to go by the start of class. If you arrive to class late, please enter quietly to minimize the disruption. If you are chronically late to class, your grade will be lowered at the end of the semester.

Homework:

Homework will be collected at the start of class on the day it is due, and the answers will be discussed in class. Your homework score will be reduced by 1 point for every minute you are late to class, and **NO LATE HOMEWORK** will be accepted after the first 10 minutes of class, so come to class early and turn your homework in on time. Turn in your homework early if you know you will be missing class the day it is due.

Academic Misconduct Policy

Academic Misconduct:

Academic misconduct is an act of deception in which the student claims credit for the work or effort of another person, or uses unauthorized materials or fabricated information in any academic work. It occurs whenever students fraudulently attempt to show possession of a level of knowledge or skill that they do not possess.

Campus Policy:

Academic misconduct is a violation of the ARC "Student Standards of Conduct" and will not be tolerated. Ignorance of these academic and behavioral standards will not absolve any student from being held responsible for them or from any disciplinary action that may result. (Please see the ARC website or the current printed class schedule for the full details of campus policies.)

Academic sanctions and penalties may be applied in cases of academic misconduct depending on the seriousness of the infraction and those grading guidelines specified by the instructor of the class.

You may:

- receive a failing grade on a test, paper or exam.
- have your course grade lowered or possibly fail the course.

In addition to these academic sanctions, disciplinary action may be taken in any case of academic misconduct. Such action will be conducted by referral to the college Disciplinary Officer. You may:

- receive a warning that continued misconduct will result in further disciplinary action.
- be placed on disciplinary probation for a specific period of time.
- be removed from the class.
- be suspended from the college for a specific period of time.
- be expelled from the college permanently.

Instructor Policy:

Collaboration is encouraged in this class, but you must do your own work.

Students who cheat on homework assignments – by copying solutions from another student, a solutions manual, the internet, or any other source of information – will receive no credit for that assignment and will receive a warning from the instructor. Repeated cheating will result in the lowering of a student's course grade at the end of the semester.

Students who cheat on an exam – by copying from another student, by illicitly obtaining information regarding test questions prior to taking the exam, or through the use of unauthorized materials during the exam – will receive no credit for that exam and will receive a warning from the instructor. Information regarding the student's misconduct will be passed on to the college Disciplinary Officer for further action. Repeated cheating on exams may result in a failing grade or the removal of the student from the class.