Physics for Science and Engineering 2 (PHY 0175)

Spring 2023 – 24

Course Description

Instructor

A.P. Lin Fang

Classroom: **3 – 106 SCUPI Building**

Lectures: Section 4 – Tuesday (8:15 – 9.55) & Thursday (10:15 –11:55)
Section 5 – Tuesday (13:50 – 15:30) & Thursday (13:50 – 15:30)

Office Hours: To be determined; online help is always available.

Teaching Assistants:

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Physics 2 (PHY 0175) is the second semester of a one-year sequence of courses in physics — a continuation of Physics 1 (PHY 0174). The course provides a calculus-based introduction electrostatic fields in free space and in dielectrics; magnetic fields due to steady and varying currents; electromagnetic induction; magnetic materials, Maxwell's equations and wave optics. The course will stress a conceptual understanding of everyday phenomena and recent technologies in terms of their basic underlying physical principles. Emphasis will be placed on understanding physical science literacy and applying physics concepts to think critically and solve problems. Blended problem-based conceptual learning will be used to gain an understanding of key developments, ideas and theories covered in this course. At the end of this course students will have a deeper understanding of concepts in electromagnetism and wave optics and be able to solve time-dependent problems in these areas. Additionally, Physics 2 covers a great deal of material which is directly relevant for various engineering programs and has been historically popular for electric, electronic and communication engineering majors.

Prerequisites

PHYS 0174 Physics for Science and Engineering 1

Course Learning Outcomes (CLOs)

On satisfying the requirements of this course, students will have the knowledge and skills to:

CLO1	Describe and understand the basic concepts underpinning electricity and magnetism such as potential and field,
CLO2	Understand the relationship between electric and magnetic fields,
CLO3	Calculate the electrostatic and magnetic fields produced by static and moving charges in a variety of simple configurations.
CLO4	Identify and apply appropriate theoretical techniques to solve a range of different problems in electromagnetism.
CLO5	Demonstrate the ability to use appropriate mathematical techniques and concepts to obtain quantitative solutions to problems in physics.
CLO6	Demonstrate the ability to use appropriate mathematical techniques and concepts to obtain quantitative solutions to problems in physics.
CLO7	Be able to combine multiple concepts and apply them to real-world concepts you are likely to see in a career in science, technology, or engineering.

Resources

Prescribed Textbook:
Principles of Physics, 10th Edition, International Student Version, Robert Resnick, David Halliday and Jeal Walker, 2014, John Wiley & Sons, 2014

Supplementary/Further Reading:
Physics for Scientists and Engineers with Modern Physics, 4th Edition, Douglas C. Giancoli, Pearson Education, Inc. NJ, 2015

Technological Resources (Virtual Lab)
Students may find the virtual simulations an effective tool for the operations of real-world processes or systems. The computer simulations are widely used and are available for free at
https://phet.colorado.edu/en/simulations/category/physics
http://www.animations.physics.unsw.edu.au/
http://www.walter-fendt.de/ph14e/

Blackboard
Please regularly log on and check https://pibb.scu.edu.cn/. Lecture notes, online quizzes, assignments, projects, announcements, and your grades will be uploaded on the PHY 0175 page of the Blackboard.

Course Content

We will cover most of the textbook material from Chapters 21-33.

Class Structure

Lectures and Laboratory.

Tutorials

Tutorials run by our TAs will start in Week 02.

Course Assessment

The final grade will be computed based on the score of weekly assignments, quizzes, midterm, and final exams.

Exams

Two midterm exams and a final exam will be given in the semester. All exams are closed-book, and cheating is not tolerated. No electronic devices will be permitted during exams. Note that the final exam is comprehensive.

Midterm Exam 1:	Week 8	2 hours duration - TBD
Midterm Exam 2:	Week 14	2 hours duration - TBD
Final Exam:	Final Week	2 hours Comprehensive

Final Grade

The final grade will be computed according to the following scheme:

Assignment/Homework & Attendance:	10%
Quizzes & Attendance:	10%
Midterm 1:	25%
Midterm 2:	25%
Final Exam:	30%

Cutoffs

A [90, 100], A- [85, 90), B+ [80, 85), B [76, 80), B- [73, 76), C+ [70, 73), C [66, 70), C- [63, 66), D+ [61, 63), D [60, 61), F (60, 0).

Assignments

Homework will be assigned on Friday every week and due by the following week on Friday at the beginning of the class. No late homework is accepted, and plagiarism is not tolerated. The lowest grade of the assignment will be dropped when computing the final grade. Discussions of the assignment problems are encouraged, but each student must submit his/her assignment. Each homework must include a Name, Student ID, and Assignment Title. Homework must be done in a structured, logical, and orderly manner, enabling the grader to verify steps, equations, and methods used readily. For collaborative assignments, grading rubrics are used for *objective and consistent assessment of various performances, assignments, and activities.* The rubrics for the collaborative projects/assignments will be uploaded to the Blackboard.

Quizzes: In-class/online quizzes will be given on tutorial session after every two weeks, starting from week 4 of this semester.

Course Policies

During Class

Computers may be allowed in class for the electronic recording of notes. But please refrain from using computers for any activities unrelated to the course. Phones are prohibited as they are rarely helpful for anything in the course. Eating and drinking are allowed in class, but please keep from it affecting the course.

Attendance Policy

Attendance is expected in all lectures. Valid excuses for absence will be accepted before class. In extenuating circumstances, valid excuses with proof will be accepted after class.

Policies on Late Assignments and Exams

Students should start their homework assignments immediately after they are given, and DO NOT wait until the last minute to meet the deadlines. Late assignments will be NOT accepted except for emergencies and health issues. Any other late assignments handed in will be marked but will be given a zero mark. At most, two extensions for assignments will be given in this course. All assignments will be counted in your total grade. Late submission for previous assignments during the final exam period will NOT be accepted in any form for any excuses.

All tests and the final exam are mandatory. There will be no makeup exam for each test. If you miss the final, a makeup exam may be given for the final exam if the student has approval from the instructor or emergencies and health issues with valid proof. I will not accept the student deceleration for absence form for the final exam.

Academic Assistance

You are encouraged to attend office hours if you have questions regarding class materials, homework problems, grading issues, etc. Otherwise, you may email the TA or the instructor. Please allow 24 to 48 hours for any response to emails. The subject of each email must include "[PHY 0175]". For example, if you have a question regarding a homework problem, the email's subject could be [PHY 0175] Question about Problem X of Assignment X. Please make sure that you sign off with your official name (the one that appears in Blackboard). You are encouraged to use academic language in your posts.

Academic Integrity

At Sichuan University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect (The Centre for Academic Integrity, Duke University, 1999). As a student, you must demonstrate these values in all your work. Everyone at SCUPI is expected to treat others with dignity and respect. The Code of Student Conduct allows Sichuan University to take disciplinary action if students do not follow this community expectation.

Special Needs:

The Office of Special Needs Services at Sichuan University ensures that students with special needs have equal access to the campus and course materials. We will work with the Office of Special Needs to provide adequate services to students with special needs.

Topical Outline of the Course Contents

The schedule is tentative and subject to change. The listed objects below should be viewed as the key concepts you should grasp after each week and also as a study guide before each exam and at the end of the semester. Each test will be based on material taught until the second week before the test; namely, Test 1 covers Weeks 01-07, and Test 2 is based on the materials covered in Weeks 09-14. The final exam will cover all topics taught in this semester.

Unit I – Static & Current Electricity

Coulomb's Law and Electric Field: Electric Charge and Coulomb's Law, Conservation and Quantization of Charge, Electrostatic Force for a System of Charges, Electric Field – Properties of Electric Lines of Force, Electric Field due to a Charged Particle and Discrete System of Charges, Electric Field Due to a Dipole, Continuous Charge Distributions, Electric Field due to a Line of Charge and Charged Disk, A Charged Particle in an External Electric Field, A Dipole in an Electric Field. Electric Flux and Gauss's Law, Applications of Gauss's Law – Planar, Cylindrical, and Spherical Symmetries.

Electric Potential and Capacitance: Conservative Force and Potential Function, Electric Potential and Potential Energy, Equipotential Surfaces, Potential due to a Charged Particle and due to a Group of Charges, Potential due to an Electric Dipole, Potential due to Continuous Charge Distribution, Calculating Field From the Potential, Potential of a Charged Isolated Conductor, Capacitance, Capacitors in Parallel and Series, Energy Stored in an Electric Field, Capacitor with a Dielectric, Dielectrics and Gauss's Law

Electric Current and Resistance: Microscopic View of Current, Drift Velocity and Current Density, Resistance, Resistivity and Temperature, Electromotive Forces, Energy and Power in Electric Circuits, Theory of Metallic Conduction, Superconductivity

Unit II – Magnetic Fields and Magnetic Forces

Magnetic Fields and Magnetic Forces: Electric Currents Produce Magnetic Fields, Force on an Electric Current in a Magnetic Field; Definition of B, Magnetic Field Lines and magnetic Flux, Force on an Electric Charge Moving in a Magnetic Field, Torque on a Current Loop; Magnetic Dipole Moment Applications of Motion of Charged Particles: Motors, Loudspeakers, Galvanometers, Mass Spectrometer, Discovery and Properties of the Electron, The Hall Effect

Sources of Magnetic Field: Magnetic Field of a Moving Charge, Magnetic Field of a Current Element, Magnetic Field of a Straight Current-Carrying Conductor, Force Between Parallel Conductors, Magnetic Field of a Circular Current Loop, Ampere's Law, Applications of Ampere's Law, Biot-Savart Law

Electromagnetic induction: Induction Experiments, Faraday's Law, Lenz's Law, Motional Electromotive Force Induced Electric Fields, Eddy Currents, Displacement Current, Applications of Induction: Sound Systems, Computer Memory, Seismograph, Mutual Inductance, Self-Inductance and Inductors, Magnetic-Field Energy

Unit III – Electromagnetic Waves and Modern Physics

Maxwell's Equations and Electromagnetic Waves: Changing Electric Fields Produce Magnetic Fields; Ampere's Law and Displacement Current, Gauss's Law for Magnetism, Maxwell's Equations, Production of Electromagnetic Waves, Electromagnetic Waves, and Their Speed, from Maxwell's Equations, Light as an Electromagnetic Wave and the Electromagnetic Spectrum, Measuring the

Speed of Light, Energy in EM Waves; the Poynting Vector, Radiation Pressure, Radio and Television; Wireless Communication

Diffraction and Polarization: Diffraction by a Single Slit, Intensity in Single-Slit Diffraction Pattern, Diffraction in the Double-Slit Experiment, Limits of Resolution; Circular Apertures, Resolution of Telescopes and Microscopes, Diffraction Grating, The Spectrometer and Spectroscopy, Peak Widths and Resolving Power for a Diffraction Grating, X-Rays and X-Ray Diffraction, Polarization, Liquid Crystal Displays (LCD), Scattering of Light by the Atmosphere

Unit IV - Thermodynamics

The Zeroth Law of Thermodynamics, Thermal Expansion, Temperature and Heat, The Absorption of Heat by Solids and Liquids, A Closer Look at Heat and Work, The First Law of Thermodynamics, Some Special Cases of the First Law of Thermodynamics, Heat Transfer Mechanisms, The Second Law of Thermodynamics, Heat Engines, Reversible and Irreversible Processes; the Carnot Engine, Refrigerators, Air Conditioners, and Heat Pumps, Entropy, Entropy and the Second Law of Thermodynamics, Statistical Interpretation of Entropy and the Second Law, Thermodynamic Temperature, Third Law of Thermodynamics.