

# PHYS 252 UNIVERSITY PHYSICS II

## **BASIC INFORMATION**

**Course prefix, catalog number, and title:** PHYS 252, University Physics II

**Number of credits:** 4 credit hours

**Term and year:** Summer 2023

**Classes:** Mon, Tue, Wed, Thurs 11:00 AM – 12:50 PM (AGHILL CTR 300)

**Instructor's name:** Md Faruk Hossain

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## **BULLETIN DESCRIPTION**

Electric charge, field, potential, and current; magnetic field; capacitance; resistance; inductance; RC, RL, LC and RLC circuits; EM waves; optics

Prerequisite: PHYS 251 or ME 222, Corequisite: MATH 166

## **COURSE OBJECTIVES**

After completing this course, you should be able to:

- Explain concepts in electricity, magnetism, wave, and optics
- Demonstrate the ability to analyze and solve conceptual and practical problems
- Construct quantitative models and descriptive predictions of physical behavior

## **REQUIRED STUDENT RESOURCES**

- Optional textbook: “University Physics with Modern Physics”, 13th Edition by Hugh D. Young, Roger A. Freedman,
- Scientific calculator

## **HOMEWORK ASSIGNMENTS**

Weekly homework will be posted on Blackboard.

All homework assignments are due on the dates specified. Late submissions will not receive credit.

## COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic	Reading /Assignment
1	Electric Charge and Electric Field, Gauss's Law	Chapters 21, 22
2	Gauss's Law; Electric Potential	Chapters 22, 23
3	Electric Potential; Capacitance and Dielectrics	Chapter 23, 24
4	Current, Resistance, and Electromotive Force; Direct-Current Circuits	Chapters 25, 26
5	Magnetic Field and Magnetic Forces; Sources of Magnetic Field	Chapters 27,28
6	Electromagnetic Induction; Inductance; Alternating Current	Chapters 29, 30, 31
7	Electromagnetic Waves, The Nature and Propagation of Light; Geometric Optics	Chapters 32, 33, 34
8	Interference; Diffraction	Chapters 35, 36

## PHYS 252 Topics Details

1. **Electric Charge and Electric Field:** charge, electric force, conductors vs. insulators, & polarization; subatomic nature of charge; Coulomb's law; quantization & conservation of charge; definition of electric field; electric field lines; electric fields of point charges, dipoles, & extended objects; acceleration of a point charge in an electric field; dipole in an electric field.
2. **Gauss's Law:** electric flux & Gaussian surfaces; Gauss' law, utilizing symmetry to determine electric fields (e.g., line of charge, sheet of charge, uniform sphere, & spherical shell); conductors (inside & outside).
3. **Electric Potential:** work & electric potential energy; electric potential & voltage; equipotential surfaces; relation between potential & field; potential due to point charges, dipoles, & continuous charge distributions; potential of an isolated conductor; electric potential energy of a system of point charges & conservation of energy.
4. **Capacitance and Dielectrics:** definition & charging a capacitor; determining capacitance (e.g., parallel plate, cylindrical); capacitors in parallel & series; energy stored in electric field & electric energy density; dielectrics.
5. **Current, Resistance, and Electromotive Force:** definition of current; current density & drift speed; definitions of resistance, resistivity, & conductivity; relation between resistance & resistivity; Ohm's law; power in electric circuits.

6. **Direct-Current (DC) Circuits:** batteries & emf; Kirchhoff's rules, single & multiloop circuits; real batteries, internal resistance, & grounding; RC circuits (charging & discharging).
7. **Magnetic Field and Magnetic Forces:** sources of magnetic fields; magnetic force on a charged particle, cross product, & right-hand rule; magnetic field lines; circular motion in a magnetic field; crossed fields & the Hall effect; magnetic force on a current-carrying wire (torque on a current loop, electric motors, magnetic dipole moment, & magnetic potential energy).
8. **Sources of Magnetic Fields:** direction of magnetic fields due to currents (right-hand rule); Biot-Savart law (e.g., infinite straight wire, circular arc of wire, axis of wire loop); force between parallel currents; Ampere's law (e.g., solenoids, toroids).
9. **Electromagnetic Induction:** Faraday's law & magnetic flux; Lenz's law; motional electromotive force; induced electric fields; Eddy currents; displacement current and Maxwell's equations.
10. **Inductance:** mutual inductance; self-inductance and inductors; magnetic-field energy; R-L circuit; L-C circuit; L-R-C circuit.
11. **Alternating Current:** phasors; direct current and alternating current; resistance and reactance; power in ac circuits; resonance in ac circuits; transformers.
12. **Electromagnetic Waves:** waves; transverse vs. longitudinal waves; wave function properties (wavelength, angular wave number, frequency, angular frequency, period, amplitude, phase constant, transverse velocity & acceleration; production & description of EM waves; electromagnetic spectrum & relation between wavelength & frequency; energy transport, Poynting vector, intensity, & relation between electric & magnetic energy densities; plane EM waves and the speed of light; energy and momentum in EM waves.
13. **The Nature and Propagation of Light:** light; nature of light; theories of light; reflection; refraction; total internal reflection; refractive index; dispersion; polarization; scattering of light; Huygens's principle.
14. **Geometric Optics:** reflection and refraction at a plane surface; reflection at a spherical surface; refraction at a spherical surface; images; real vs. virtual images & mirages; plane mirrors; spherical mirrors; lenses; the magnifier; microscopes; telescopes.

15. **Interference:** coherent sources; superposition of waves; interference; phase difference due to path-length difference; double-slit interference (fringe locations & variation of intensity); thin-film interference & phase-shift due to reflection.
16. **Diffraction:** definition of diffraction; Fresnel and Fraunhofer diffraction; single-slit diffraction; diffraction grating.

### **EVALUATION PROCEDURES AND GRADING CRITERIA**

Final letter grades for the course will be computed using the following weights:

- Homework Assignment: 60%
- Two Exams: Midterm: 20%, Final: 20%

NO MAKEUP EXAMS ARE ALLOWED

**Grades:** A: > 90 %, B: 80 to < 90%, C: 70 to < 80 %, D: 60 to < 70%, F: < 60 %

### **Academic Honesty and Special Needs:**

The academic community is operated on the basis of honesty, integrity, and fair play.

NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

Informational resources about academic honesty for students and instructional staff members can be found at [www.ndsu.edu/academichonesty](http://www.ndsu.edu/academichonesty).

Any students with disabilities or special needs, who need accommodations in this course, are invited to share concerns or requests with the instructor and to contact the Disability Services Office ([www.ndsu.edu/disabilityservices](http://www.ndsu.edu/disabilityservices)) as soon as possible.