## Electromagnetism

3 credits

**Bulletin Description:** Review of Maxwell's equations, radiation, collisions between charged particles, dynamics of relativistic particles and fields. Prerequisite: PHYS 361 or similar course

**Instructor:** Andrei Kryjevski, South Engineering 318D

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Meetings: Tu Th 3:30 PM -4:45 PM Office Hours: W 14:00-16:00

South Engineering 221 (or by arrangement)

Goal: To master the theoretical foundations and the basic practical applications of classical electrodynamics

**Student Responsibilities:** Read assigned material in advance. Come prepared for discussion. Ask questions and give me feedback. Complete assignments on time.

Texts: J. Jackson, Classical Electrodynamics, 2nd edition (Wiley, 1975),

L. D. Landau, E.M. Lifshitz, **The Classical Theory of Fields: Volume 2**, 4th edition (Reed, 1987)

## Major Topics:

- Introduction: Summary of experimental facts underlying classical electrodynamics, charge conservation, deduction of Maxwell equations
- Electrostatics: Gauss's law, scalar potential, Poisson and Laplace equations, Green function of Poisson equation, general solution for the scalar potential, Dirichlet and Neumann boundary conditions, Laplace equation in rectangular, spherical, cylindrical coordinates, multipole expansion (Jackson, Ch. 1, 2, 3, 4)
- Magnetostatics: Vector potential, Biot and Savart law, B-field of a localized current distribution, magnetic moment (Jackson, Ch. 5)
- Time-dependent fields: Maxwell equations, gauge transformations, Lorentz and Coulomb gauges, Green functions for the wave equation, energy of electromagnetic field, Poynting vector (Jackson, Ch. 6)
- Electromagnetic waves and wave propagation: Polarization, reflection and refraction (Jackson, Ch. 7)
- Simple radiating systems: Radiation from a localized oscillating source, electric dipole, magnetic dipole, electric quadrupole fields, scattering, diffraction (Jackson, Ch. 9)
- Radiation by moving charges: Lienard-Wiechert potentials and fields, Larmor's formula, Thompson scattering of radiation (Jackson, Ch. 14)

**Evaluation:** weekly homework assignments will be posted on Blackboard (55%); midterm exam (20%), comprehensive final exam (25%)

**Homework and Lateness:** Group discussion of homework is strongly encouraged, but written solutions must be your own. Late work will be accepted with a 20% penalty/day until next class.

**Grading:** A: 90-100%, B: 70-89.9%, C: 60-69.9%, D: 50-59.9%, F: < 50%

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.

Any students with disabilities who need accommodation in this course are encouraged to speak with the instructor as soon as possible to make appropriate arrangements.