《Electrodynamics》 Course Syllabus

1. Basic information

Course ID：3150320011103		Title：Electrodynamics
Department ： School of Physics and Technology		Students：Hongyi College (Physics)
Credits：4		Duration：64 hours lecture
Teacher	Name：Shengjun Yuan	Email：s.yuan@whu.edu.cn
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Course type：Compulsory Course		
Prerequisites：Advanced Mathematics		

2. Course Description

Electrodynamics is a fundamental course in physics and aims to provide undergraduate students with an introduction to the principles and behaviors of dynamical electric and magnetic systems. The main contents include (1) Mathematical preliminaries: Vectors analysis, Laplace's equation, generalized functions, orthogonal transformations, Cartesian tensors, Helmholtz theorem. (2) Electrostatics: Gauss's Law, the method of images, separation of variables, multipole expansion, polarization, linear dielectrics. (3) Magnetostatics: Lorentz force, Biot-Savart law, magnetic vector potential, magnetization, magnetic susceptibility and permeability. (4) Maxwell's Equations: electromotive force, electromagnetic induction,

differential and integral forms of Maxwell's equations, boundary conditions, continuity equation, Poynting's theorem, Maxwell's stress tensor. (5) Electromagnetic waves: waves in a medium, reflection and transmission, absorption and dispersion, guided waves. (6) Potentials and fields: scale and vector potential, Gauge transformations, retarded potentials, Jefimenko's equations, Lienard-Wiechert potentials. (7) Radiation: electronic and magnetic dipole radiation, radiation of point charges. (8) Electrodynamics and relativity: special theory of relativity, Galilean and Lorentz transformations, four-vectors and field tensor, covariant form of Maxwell equations. (9) Numerical solutions of the time-dependent Maxwell equations: Finite-difference Time-domain Method.

3. Course contents and durations

Contents	Durations (hours)
Mathematical Preliminaries	8
Electrostatics	8
Magnetostatics	8
Maxwell's Equations	10
Electromagnetic Waves	8
Potential and field	4
Radiation	4
Electrodynamics and Relativity	8
Numerical Methods for Maxwell's Equations	6

4. Assessments

    Home Exercises 20%

    Midterm written exam 20%

    Final written exam 60%

5. Textbook and References

Textbook: Introduction to Electrodynamics, 4th Edition, by David J. Griffiths，Cambridge University Press

Reference: Classical Electrodynamics (Photocopy Edition) (Third Edition), by John D. Jackson, Higher Education Press.