SYLLABUS

Phys. 210A: E&M
Jan 6, 2006
Leonid Pryadko

Instructor:	Leonid Pryadko <leonid@landau.ucr.edu>
Office:	Physics 3040, phone: (951) 827-5644
Lectures:	Mon, Wed, Fri, 9:10am to 10:00am, Physics 3035
Office Hours:	"open door"

Texts

L8 L. D. Landau and E. M. Lifshitz, *"Theoretical physics"*, vol. VIII "Electrodynamics of continuous media" (any edition).

J J. D. Jackson, *Classical Electrodynamics*, Wiley & Sons, N.Y., 3rd ed. (1998). [You can also use 2nd edition which may even be more convenient because Gaussian units are used throughout the text. Also, see "References and Suggested Reading" at the end of every chapter in Jackson.]

L2 L. D. Landau and E. M. Lifshitz, *"Theoretical physics"*, vol. II "The classical theory of fields" (any edition).

F2 R. P. Feynman, R. B. Leighton, and M. Sands, *"The Feynman Lectures on Physics"*, Vol. II (any edition).

M Jon Mathews and R. L. Walker "Mathematical Methods of Physics" (any edition).

JF Jerrold Franklin "Classical electromagnetism" (any edition).

Homeworks

The homework constitutes 40% of the grade. Late homework will receive reduced credit. On weekly problem sets, the solutions will be generally given one week after the due day. No more than 10% credit will be given for homework submitted after solutions are out. The score can be improved by solving extra credit problems.

Examinations

There will be several 10-minute quizzes, one midterm and one final exam (all in class, closed book, only hand-written single-sided page formula sheet allowed). The quizzez will constitute 10% of the grade. The two exams, respectively, will constitute 10% and 40% of the total score.

Tentative course outline

Jan 6—Jan 11: Introduction. Maxwell's equations in vacuum. Limit of static charges. Gauss's law. Green's theorem. Earnshaw's theorem. Surface distribution of charges and dipoles.
F2, Chap. 1, 6-2; **J**: I.1–I.6, 1.1–1.2; **LL2** §28, §40.
F2: Chap. 2, 3, 4, 5-1 to 5-7, 6-1 to 6-5; **J**: 1.3 to 1.5

Jan 13—Jan 18: Boundary-value problems in electrostatics. Uniqueness of the solution. Green's function. Energy in electrostatics. Mutual capacitance coefficients. Variational approach.
J: 1.6 to 1.9; **F2**: 7-1, 7-3, 7-4
LL8: \$2; **J**: 1.11; **F2**: Chap. 8.
F2: 5-5 to 5-8, 7-5
M: 8-1 to 8-4

Jan 20—Jan 25: Guessing the solution: methods of images, spherical inversion, and conformal mapping. Corners and edges. Electrostatic analogies.
LL8: §1–§3; **J**: 2.1–2.5; **F2**: 5-9, 5-10, 6-6 to 6-10, 7-1, 7-2
M: 5-1

Jan 27—Feb 6: Phenomenology of dielectrics. Ferroelectricity and piezoelectricity. Boundary-value problems with dielectrics. Electrostatic energy in dielectric media.
LL8: §6, §7, §11, §14; **J**: 4.3–4.7

▸ **Feb 1**: Midterm (material covered in January).
No classes on Jan 30 and Feb 3.

Feb 8—Feb 10: General boundary-value problems. Separation of variables and series expansions. Generalized Fourier series.
General orthogonal coordinates. **J**: 1.6, 1.7, 1.8, 1.10, 2.6, 2.7
J: 2.8, 2.9, 2.10; **LL8**: §3
M: 9-1 to 9-5

Feb 13–Feb 17: Laplace's equation in cylindrical and spherical coordinates. Multipole expansion. Spherical harmonics. Properties, addition theorem, plane wave expansion. Bessel functions. Integral representations, expansions, and asymptotics.
J: 3.1–3.6, 3.10, 4.1, 4.2
M: 7-1, 7-2

Feb 20—Feb 24: Stationary currents. Maxwell's equations in the limit of magnetostatics. Vector potential and magnetic field of fixed currents. Boundary value problems in magnetostatics. Dia-, para-, and ferromagnetism. Energy in magnets.

Feb 27—Mar 10: Quasistationary currents and magnetic fields. Faraday's induction law. Eddy currents. Skin depth. Ideal conductors and superconductors.

▸ **Final exam**: Tue, Mar 21, 9:00am – 1:00pm