Electrodynamics II

Physics 931 **KSU**
TU 1:05 - 2:20 Spring 2006
3 credit hours Cardwell 146

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Goals of Course

1. Analyze and apply electric and magnetic field concepts.
2. Learn and use advanced mathematical physics techniques.

Concepts

1. Radiation from oscillating sources.
2. Scattering and multipole radiation fields.
3. Special Relativity and Maxwell's equations.
4. Radiation from accelerated charges.
5. Interaction of charges with radiation.

Techniques

1. Green function for wave equation.
2. Lagrangian formalism for charge in a field.
3. Lagrangian formalism for continuum fields.
4. Invariance under transformations.
5. Spherical wave expansions.

Grading

Grades will be determined mostly from three exams, as follows:

Task:	Points:	Grading scale:
a) Exam 1, Chs. 9, 10	300	A: 1000–880
b) Exam 2, Chs. 11, 12	300	B: 880–760
c) Exam 3, Chs. 14, 16	200	C: 760–640
d) Homework Presentations	200+	D: 640–520

There will be around 12 homework assignments, intended for applying your understanding of the topics. You can abtain credit for doing the HW by presenting solutions orally in the problem sessions (about once per week) with each problem worth up to 50 points. You can present as many as you like but preference will be given to those who've done the least. Concise and clear explanations are expected; avoid excessive algebra or other tedious details.

Disabilities

If you have any condition such as a physical or learning disability, which will make it difficult for you to carry out the work as I have outlined it or which will require academic accommodations, please notify me and contact the Disabled Students Office (Holton 202), in the first two weeks of the course.

Plagiarism

The University requires a statement on plagiarism in the syllabus. As scientists in training, high professional standards of integrity and ethics are expected of you. While you are encouraged to discuss questions with me or with other students, what you hand in must be your own work. Copying from others or from textbooks is considered plagiarism.

Plagiarism and cheating are serious offenses and may be punished by failure on the exam, paper or project; failure in the course; and/or expulsion from the University. For more information refer to the "Academic Dishonesty" policy in K-State Undergraduate Catalog and the Undergraduate Honor System Policy on the Provost's web page at http://www.ksu.edu/honor/.

Course Schedule

The textbook for the course is *Classical Electrodynamics*, by J. D. Jackson, 3rd edition, 1999. An approximate schedule of the topics to be covered is as follows:

Lecture/Date	Topic	Sections
1. 1-12	Localized oscillating radiating sources	9.1-9.2
2. 1-17	Dipole and quadrupole radiation	9.3-9.4
3. 1-19	Spherical scalar waves, EM multipoles	9.6-9.7
4. 1-24	Energy, angular momentum, power distribution	9.8-9.9
5. 1-26	Multipole moments, atomic, nuclear	9.10-9.11
6. 1-31	Linear center-fed antenna	9.12
7. 2-2	Scattering at long wavelengths by dipoles	10.1
8. 2-7	Scattering by a continuous medium	10.2
9. 2-9	Spherical vector plane waves	10.3
10. 2-14	Spherical scatterers	10.4
11. 2-16	Relativity and experiments	11.1-11.2
Monday 2-20	**First Exam.**	**Chs. 9, 10**
12. 2-21	Lorentz transformation and kinematics	11.3
13. 2-23	4-vectors, velocity addition, energy-momentum	11.4-11.5
14. 2-28	Lorentz group and mathematical notation	11.6-11.7
15. 3-2	Thomas precession for spin	11.8
16. 3-7	Covariance of electrodynamics	11.9
17. 3-9	Transformation of EM fields	11.10
18. 3-14	Lagrangian, Hamiltonian for charge in field	12.1
19. 3-16	Motion in uniform fields	12.2-12.3
3-21, 3-23	Spring Break, no class.	
20. 3-28	Motion in nonuniform fields	12.4-12.5
21. 3-30	Darwin Lagrangian, EM field Lagrangian	12.6-12.8
22. 4-4	Stress tensors, conservation laws	12.10
23. 4-6	Covariant wave equation Green function	12.11
Monday 4-10	**Second Exam.**	**Chs. 11, 12**
24. 4-11	Liénard-Wiechert potentials, accelerated charge	14.1-14.2
25. 4-13	Angular distribution of radiation, synchrotrons	14.3-14.4
26. 4-18	Frequency distribution of radiation	14.5-14.6
27. 4-20	Thomson scattering of radiation	14.8
28. 4-25	Radiation damping concepts	16.1-16.2
29. 4-27	Abraham-Lorentz self force	16.3-16.4
30. 5-2	Covariant EM energy-momentum	16.5-16.6
31. 5-4	Spectral line properties of radiating oscillators	16.7-16.8
Tuesday 5-9	**2:00 - 3:50 pm, Third Exam.**	**Chs. 14,16**