

Physics 4322
Spring 2018 - Section 13301

Introduction to Classical Electrodynamics - Part 2

Text - *Introduction to Electrodynamics*; - David Griffiths
Publisher - Prentice-Hall

Supplementary Material - Feynman Lectures on Physics - R. Feynman (Addison-Wesley, 1965 - use library editions); Electrodynamics (Chicago Lectures in Physics); T. Tsang; Student's Guide to Maxwell's equations; A. P. French Relativity

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Spring 2018
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Week Beginning	Lecture	Homework	Due Date
	***** MLK Day Jan 15 *****		
Jan 14	Ch 1-6	2.26, 3.24, 4.33, 5.35	Jan 23
Jan 21	Ch 7	7.1, 7.5, 7.8, 7.18	Jan 30
Jan 28	Ch 7	7.25, 7.28, 7.36, 7.58	Feb 6
Feb 4	Ch 7,12	12.4, 12.5, 12.8, 12.9	Feb 13
	***** 1 st Exam Feb 8 *****		
Feb 11	Ch 12	12.11, 12.15, 12.19, 12.27	Feb 20
Feb 18	Ch 12	12.33, 12.37, 12.43, 12.50	Feb 27
Feb 25	Ch 8	8.1, 8.3, 8.5, 8.6	Mar 6
Mar 4	Ch 8	8.7, 8.10, 8.11, 8.14	Mar 20
	***** Spring Holiday Mar 11-18 *****		
Mar 18	Ch 9	9.2, 9.4, 9.11, 9.13	Mar 19
	***** 2 nd Exam Mar 20 *****		
Mar 25	Ch 9	9.20, 9.25, 9.29, 9.38	Mar 26
Apr 1	Ch 10	10.1, 10.4, 10.7, 10.10	Apr 2
Apr 8	Ch 10	10.12, 10.15, 10.19, 10.23	Apr 9
Apr 15	Ch 11	11.1, 11.4, 11.6, 11.9	Apr 16
Apr 22	Ch 11	11.14, 11.15, 11.23, 11.31	Apr 23
	***** 3 rd Exam Apr 26 *****		

Last Date to Drop — Apr 3
last Day of Class — Apr 30
Final Exam — Thu May 10 - 5:00-8:00p

The course will cover the topics of;

1. *Review of Eletrostatics*

- (a) *Coulomb's Law*
 - i. *Electric Field*
 - ii. *Scalar Potential*
- (b) *Current Density*
- (c) *Ampere's Law*
- (d) *Biot-Savart Law*
 - i. *Magnetic Field*
 - ii. *Vector Potential*
- (e) *Static Maxwell's Equations*

2. *Electromotive Force and Moving Charge*

- (a) *Lorentz Force*
- (b) *Electromotive Force*
- (c) *Magnetic Flux - Induction*
- (d) *Faraday's Law*
- (e) *Electric Circuits*
 - i. *Ohm's Law*
 - ii. *Inductance*
 - iii. *Time Dependent Currents*
- (f) *Time Dependent Field Energy*
- (g) *Time Dependent Maxwell's Equations*
 - i. *Displacement Current*
 - ii. *Magnetic Charge*
 - iii. *Maxwell's Equations in Matter*
- (h) *Boundary Conditions*

3. *Relativity*

- (a) *Simultaneous Events*
- (b) *Postulates*
- (c) *Lorentz Transformation*
- (d) *Views of Rapidly Moving Objects*
 - i. *Moving Rod*
 - ii. *Moving Clock*

iii. 2-Dimensional Moving Object

- (e) Twin Paradox*
- (f) Relativistic Transformations*
 - i. 4 Vector Notation*
 - ii. Energy-Momentum*
 - iii. 4 Potential*
 - iv. Field Transformations*
 - v. Covariant Notation*
- (g) Kinematics*
- (h) Proper Time*
- (i) World Line*

4. Symmetry and Conservation Laws

- (a) Equation of Continuity*
- (b) Gauge Invariance*
- (c) Poynting Theorem - Conservation of Energy*
- (d) Stress Tensor - Conservation of Momentum*
- (e) Conservation of Angular Momentum*

5. Wave Equation

- (a) Solutions*
- (b) Amplitude and Intensity*
- (c) EM Waves*
 - i. Complex Notation*
 - ii. Plane Waves*
 - iii. Spherical Waves*
 - iv. Spectrum*
 - v. Energy and Momentum*
 - vi. Waves in Materials*
- (d) Transmission Lines*
 - i. Reflection and Transmission*
 - ii. Impedance*
 - iii. Dispersion and Absorption*
- (e) Polarization*
- (f) Reflection from Surfaces*
- (g) Wave Guides*

- i. Rectangular Guides*
- ii. Modes - TE, TM, TEM*
- iii. Coaxial Guides*

(h) EM Waves in Conductors

6. Potential Formulation

(a) Maxwell's Equations in Potential Form

(b) Coulomb and Lorentz Gauge

(c) Retarded Potentials

(d) Fields of Point Charge

i. Lienard-Wiechert Potentials

ii. Jefimenko Equations

7. Radiation and Scattering

(a) Fields of a Moving Charge

(b) Electric Dipole Field

(c) Magnetic Dipole Field

(d) Spherical Harmonics

(e) Multipole Expansions

(f) Radiated Power

(g) Dipole Absorption and Scattering

(h) Radiation Reaction

Your grade will be determined by:

3 in class exams 18% each

Home work 20%

Final Paper 26%

It is expected that the student has an understanding of Electrostatics as taught in the first semester of this 2-semester course. Also it is assumed that the student has a mathematical background through the level of partial differential equations. While these subjects will be reviewed, they will be impossible to cover in the necessary depth needed for his class.

*The Text covers a substantial amount of material, and the material is difficult. The student must devote the necessary time to learn the it. **ATTEND CLASS and see me if you are having difficulty. DO THE HOMEWORK. THIS MEANS DO IT YOURSELF. DO NOT COPY A SOLUTION EXPECTING TO UNDERSTAND IT** You cannot do well without doing the homework, and in fact you should work more problems than just what is assigned. What you take away from this course will be a strong function of your dedication in learning the material.*

Turn the homework in on the date assigned. Late homework is not accepted. Homework solutions will be posted on the class website. There will be 3 in-class exams and a 3hr final. Grades are determined as outlined by that percentages above.

All your submitted class work must be completed independently by you, although you may discuss the homework problems with others.