Lahore University of Management Sciences

PHY 502 – Electrodynamics 1

Fall 2016

Instructor	Dr. Muhammad Sabieh Anwar
Room No.	
Office Hours	
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Secretary/TA	
TA Office Hours	
Course URL (if any)	http://physlab.org/courses-taught/

Course Basics				
Credit Hours	3			
Lecture(s)	Nbr of Lec(s) Per Week	2	Duration	75 minutes
Recitation (per week)	Nbr of Rec (s) Per Week	0	Duration	N/A
Lab (if any) per week	Nbr of Session(s) Per Week	0	Duration	See timetable issued by Registrar's office.
Tutorial (per week)	Nbr of Tut(s) Per Week	1	Duration	60 minutes

Course Distribution	
Core	
Elective	For Physics and EE Majors and Physics and EE Graduate (MS and PhD) Students
Open for Student Category	SSE
Closed for Student Category	N/A

COURSE DESCRIPTION
The course electrodynamics-1 is first part of a series of courses on electromagnetic theory aimed primarily at graduate students. In this course we will cover Maxwell's equations and describe primarily static electric and magnetic interactions while the subsequent course will deal with dynamic interactions and the coupling between electricity and magnetism. At the start of the course we will review some mathematical details

concerning vector calculus, the Helmholtz theorem and Lagrange multipliers and will introduce the concept of Green's functions. However, most of the mathematical machinery will be introduced in parallel with the physics. Several interesting applications will be dealt during the course.

COURSE PREREQUISITE(S)	
•	Although there are no formal pre-requisites for this course, all students must have a good working knowledge of electromagnetism. At LUMS, the courses that deal with this body of knowledge are PHY 204, PHY 305. A sound mathematical appreciation of coordinate systems, curvilinear coordinates, multivariable calculus and vector calculus is a must too.

COURSE OBJECTIVES	
•	Understanding Maxwell's equations, their meaning and applications
•	Understanding the role of a medium, and interfaces between mediums and how electromagnetic interactions lead to interesting effects inside mediums and at their boundaries

Learning Outcomes	
	After successful completion of this course, students should be able to: 1. Spell out Maxwell's equations and describe their meaning and significance, 2. Apply their knowledge of electrostatics and magnetostatics to solving problems some of which carry technological importance, 3. Readily consider the energetic aspects of electric and magnetic interactions, 4. Formulate interactions in terms of scalar and vector potentials.

Grading Breakup and Policy

Grading will be absolute if number of students is less than 20. I have the liberty of changing the grading criterion by 5%.

Homework	35%
Mid-Term	25%
Final Exam	40%

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Examination Detail	
Midterm Exam	Yes. Closed book, closed notes.
Final Exam	Yes. Closed book, closed notes.

COURSE OVERVIEW		
Week/ Lecture/ Module	Topics	Recommended Readings
1.	Mathematical Preliminaries: Fourier analysis, curvilinear coordinates, coordinate transformations, Helmholtz theorem, Lagrange multipliers	Ch. 1
2.	Review of Maxwell's Equations	Feynmann-Dyson's proof of Maxwell's equations (AJP 58, 209 (1990))
3.	Electrostatics: Gauss's law, scalar potential, electrostatic stress tensor	Ch. 3
4.	Electric multipoles: dipoles, quadrupoles, spherical multipoles	Ch.4
5.	Mid-term	
6-7.	Electrostatics inside matter: dielectric, capacitance, screening, shielding	Ch. 5 and 6
8.	Laplace's Equation	Ch. 7
9-10.	Poisson's Equation: method of images, Green's function method	Ch. 8
11.	Steady current: resistance, Joule heating, batteries	Ch. 9
12.	Magnetostatics: Biot-Savart law, Ampere's law,	Ch. 9
13-14.	Magnetic scalar and vector potential and review	Ch. 10
15.	Final exam	

Textbook(s)/Supplementary Readings
1. Modern Electrodynamics, Andrew Zangwill, Cambridge University Press (2013). A review of the book is attached.