

Electrodynamics

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Version: €1.000

MCI



M.Sc - Electrodynamics



1. Introduction

Introduction



First Steps

Introduction

Final Examination

Point Distribution

Table of Contents

Resources



- The goal of this lecture is to give you the fundamentals of electrodynamics and improve your mathematical methods of solving problems.
- This lecture is a total of 2 SWS with a total of thirty (30) hours.
- There is a written exam at the end of the lecture series.
- There is **NO** assignment for this course



- The exam will consist of topics discussed in the lecture.
- You will be given the necessary functions and definitions needed to solve the questions.
- NO custom documents and/or formula sheets will be allowed.
 - You are allowed to bring a calculator to the exam.
- The exam will take 90 mins and will focus on more numerical aspects of electrodynamics.



Assessment Type	Overall Points	Breakdown	%
Final Exam	100		
		Q1	25
		Q2	25
		Q3	25
		Q4	25

Table 1: Assessment Grade breakdown for the lecture.



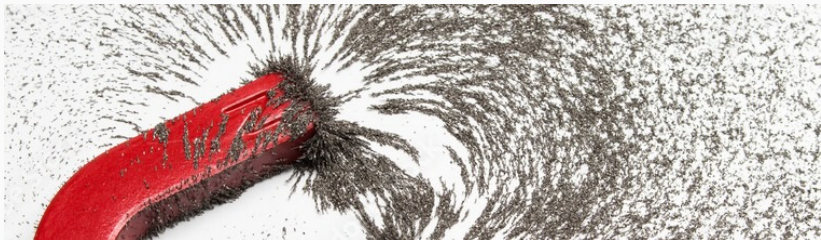
Covered Topic	Appointment
The Point of Electromagnetism	1
Vector Algebra	2 - 3
Electrostatics	4
Electric Fields in Matter	4
Magnetostatics	5
Magnetic Fields in Matter	6
Electrodynamics	6 - 7
Charge and Energy	8
Electromagnetic Waves	8 - 9

Table 2: Distribution of materials across the semester.



The Point of Electromagnetism

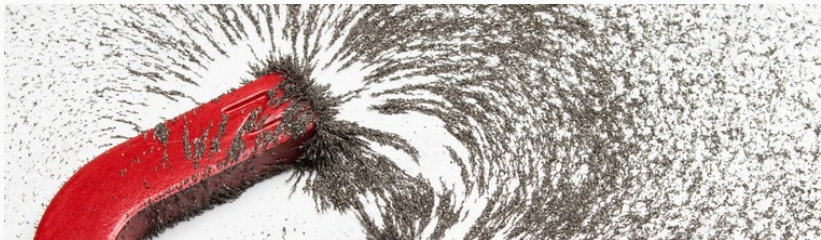
- The Four realms of Mechanics,
- History of Electromagnetism,
- The Four fundamental Forces,
- Unification of Electricity and Magnetism.





Vector Algebra

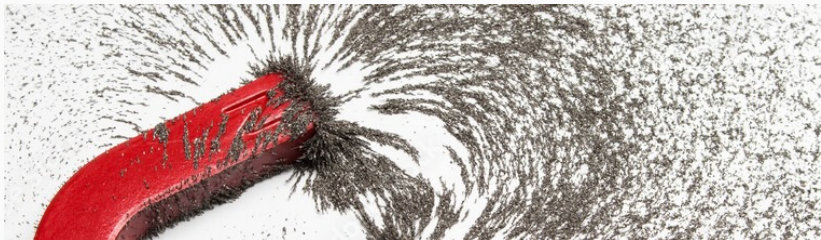
- Gradient,
- Divergence,
- Curl,
- Line Integrals.





Electrostatics

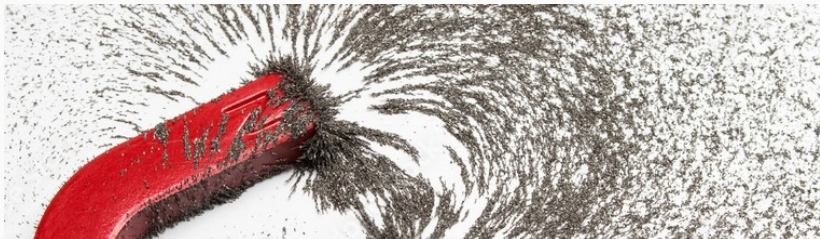
- The Electric Field,
- Curl and Divergence of \mathbf{E} ,
- Electric Potential,
- Work and Energy.





Advanced Mathematical Methods

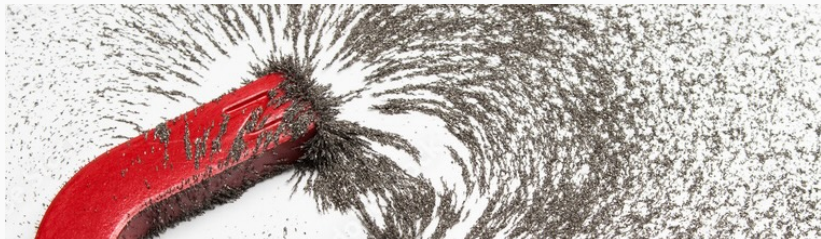
- Laplaces Equation,
- Method of Images,
- Separation of Variables,
- Multipole Expansion.





Electric Fields in Matter

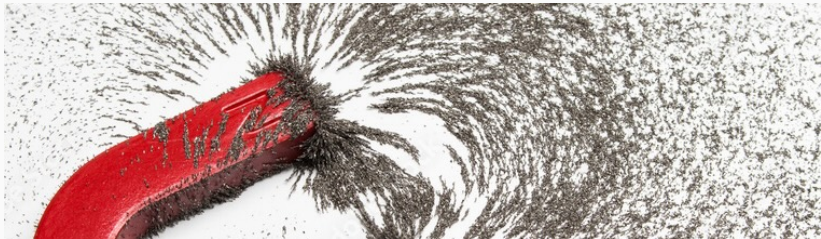
- Polarisation,
- The Field of a Polarised object,
- The Four fundamental Forces,
- Dielectric Material Properties.





Magnetostatics

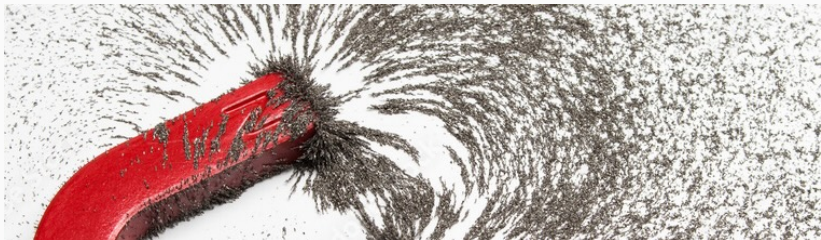
- Lorentz Force Law,
- Steady Currents,
- Divergence and Curl of \mathbf{B} ,
- Vector Potential.





Magnetic Fields in Matter

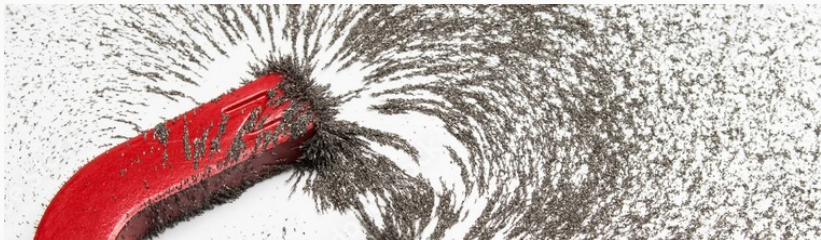
- Dia, Para, and Ferro magnets
- The Field of a Polarised object,
- Field of a Magnetised object,
- Auxiliary Field \mathbf{H} .





Electrodynamics

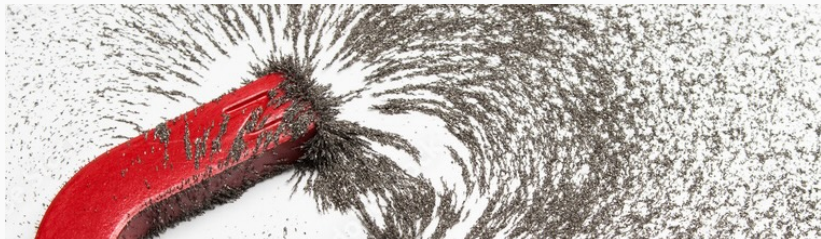
- Electromotive Force
- Electromagnetic Induction,
- Maxwell's Equations,





Charge and Energy

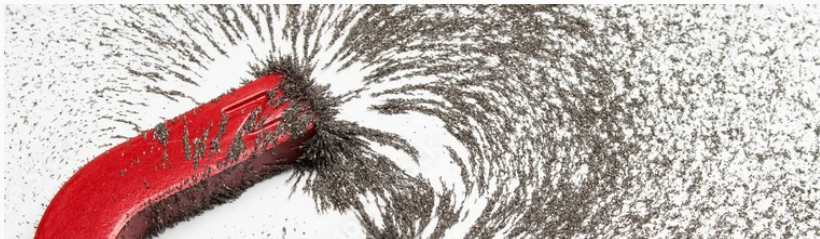
- The continuity equation
- Poynting's Theorem,
- Newton's 3rd Law - revised.





Electromagnetic Waves

- Waves in 1D
- EM Waves in a Vacuum
- Absorption and Dispersion,
- Wave guides.





Books

- Maggiore Michele "*A modern introduction to classical electrodynamics*" Oxford University Press (2023).
- Griffiths David J. "*Introduction to Electrodynamics (4th Edition)*" Cambridge University Press (2023).
- Cheng David Keun. "*Field and Wave Electromagnetics*" Pearson Education India (1989).
- Schaum's *Electromagnetics*