

Birla Institute of Technology & Science -Pilani, K K Birla Goa
Campus Semester2 2019-2020
Course Handout (Part II)

Date: January 1, 2025

Course No.: PHY F241

Course Title: Electromagnetic Theory II

Instructor: Rudranil Basu (IC), Sourish Banerjee (TA)

1. Course overview:

This course is a continuation of the course Electromagnetic Theory I. This course will mainly focus on the dynamic features of the electric and magnetic fields rather than the static properties studied in the previous course, thus delving deeper into the concepts of electricity and magnetism as manifestations of the unified electromagnetic field. A sound working knowledge of electrostatics and magnetostatics is essential for this course.

2. Course Outcomes:

- a. Understanding of the basic concepts in electrodynamics and application of Maxwell's equations in understanding the behaviour of electromagnetic waves in vacuum or other media.
- b. Effect of electromagnetic field on the motion of a test charge particle.
- c. Techniques of obtaining solutions to Maxwell's equations in a bounded region.
- d. Basic understanding of physics involved in electromagnetic radiation.
- e. Strengthening mathematical techniques for handling vector and tensor analysis in 3 and 4 dimensions.
- f. Appreciating that special relativity is inherently built up in the basic structure of electromagnetism.

3. Text Books

- a. [T1] Introduction to electrodynamics by David J. Griffiths, 3rd edition, Pearson.
- b. [T2] TEXTBOOK ON THEORETICAL PHYSICS. VOL. 2: CLASSICAL FIELD THEORY by L.D. Landau, E. M. Lifshitz.
- c. [R1] Classical Electrodynamics by J. D. Jackson, 3rd edition.
- d. [R2] The Feynman Lectures on Physics, Vol. II
- e. [R3] Electricity and Magnetism by Edward M. Purcell and David Morin.

4. **Consultation hours:** Feel free to drop me an email so that we can schedule a meeting time at my office.
5. **Make-up Policy:** In case of a medical emergency preventing one from appearing in the Mid-sem or Comprehensive examination, a 'make-up' examination may be allowed. No such request can be accommodated for class tests.

6. Evaluation Scheme and weightage:

Sr. No.	Evaluation Component	Duration	Weightage (%)	Date & time	Nature
1	Midsem	1.5 hours	30	6th March, 2025. 4 PM	Closed book
3	Assignment*		10	-	Open book
4	Class tests	3/4 no.s (each of duration 45 minutes)	25	-	Open book
5	Comprehensive Exam	3 hours	35	7th May, Forenoon	Closed Book

To be submitted to Sourish Banerjee. No marks will be awarded for submissions made after the respective deadlines.

7. Break-up of Lectures (can vary widely):

No. of Lectures	Topics	Reference
2	Maxwell's equations in free space and matter	T1 Chapter 7, R2 Chapter 18
4	Conservation principles	T1 Chapter 8, T2 Chapter 4
8	Potential formulation of electrodynamics, Gauge transformations. Field of moving charges, Retarded potentials, Liénard–Wiechert potential.	T2 various portions, T1 chapter 10, R3 various portions

8	EM waves in vacuum, matter and propagation of EM waves through dielectric media. Reflection, refraction and transmission at the dielectric interface. (Optional: Absorption and dispersion of EM waves.)	T1 Chapter 9, T2 chapter 6
7	Radiation, electric dipole radiation, magnetic dipole radiation, radiation from an arbitrary localized source, radiation of a point charge, and radiation reaction.	T1 Chapter 11, T2 Chapter 9
8	Electrodynamics as a Lorentz covariant theory	T2 chapter 1-3, various parts

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