FEN - EDEBİYAT FAKÜLTESİ
FACULTY OF ARTS AND SCIENCES
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DEPARTMENT OF PHYSICS

Study Guide and Suggested Problems

FOR THE COURSES PHYS331 & PHYS332

Please Read

This document contains suggested problems for the courses Electromagnetic Theory I-II (Phys331, Phys332). The list is *not necessarily* comprehensive; however, it would give the student an idea of how well they are doing in these courses: they are expected to be able to solve all these questions eventually!

Although students are expected to be able to solve *all* questions in this list, *I as the instructor do not suggest them to sit down and solve all questions*! Depending on how well they are doing, on how much time they can spare for this course, and on how useful they find solving these questions are for them, they should *themselves* decide to choose which subset of these questions they would like to solve!

Books

All suggested problems are from the books specified in the syllabus, namely

(1) *Introduction to Electrodynamics* by Griffiths
(4th edition: ISBN 978-1-292-02142-3).

(2) *Electricity and Magnetism* by Purcell and Morin
(3rd edition: ISBN 978-1-107-01402-2)

(3) *Modern Electrodynamics* by Zangwill
(ISBN 978-0-521-89697-9)

(4) *Classical Electrodynamics* by Jackson
(3rd edition: ISBN 0-471-30932-X)

Phys331

Preliminaries:
Electromagnetic theory, hence these courses, are heavily based on vector analysis; in particular, fundamentals of vector spaces, linear algebra, differentiation of vector fields (grad, div, curl, laplacian), and integration of vector fields (such as line integrals) along with various integral theorems (such as Stokes' theorem) are vital to understand concepts in electromagnetism!

Ideally, students are supposed to have learned these topics through the course Phys210 (Mathematical Methods in Physics II) which is taught a semester earlier in the curriculum; however, since Phys210 is not officially a prerequisite course for Phys331, we cover the first

chapter of Griffiths in the class which introduces necessary ingredients. Note that this chapter should be seen mostly as a reminder because much of these contents (such as spherical coordinates) are already covered in *Calculus II* (for instance, see here).

In addition to being a reminder of calculus courses, the first chapter of Griffiths also introduces / reviews some concepts that are supposedly covered in the prerequisite course Phys209 (Mathematical Methods in Physics I), such as the *Dirac delta distribution*. Again, we discuss these in class as well, so you are supposed to know these topics in sufficient detail.

Considering that different people might have taken Calculus & Phys209 courses in different times from different instructors, there is a reasonable chance that your particular background in these topics is not of sufficient excellency; hence, I suggest that you *at least have a look at* all the questions of this chapter:

Chapter *Vector Analysis* , Problems 1-63 [1]

1 Electrostatics

1.1 The electric field and its differentiation

Chapter *Electrostatics*, Section 1 & 2, Problems 3-7,10,14-16,18,45-47,50 [1]

1.2 Electric scalar potential

Chapter *Electrostatics*, Section 3, Problems 20,25-27,30 [1]

1.3 Work and energy in electrostatics

Chapter *Electrostatics*, Section 4, Problems 33-36,49 [1]

1.4 Conductors

Chapter *Electrostatics*, Section 5, Problems 38-39,41-44 [1]

1.5 Analytical tools in electrostatics

Laplace's equation and seperation of variables
Chapter *Potentials*, Section 1 & 3, Problems 3,13-16,19,21,25,26,43,45 [1]

The method of images
Chapter *Potentials*, Section 2, Problems 7,10-12,39 [1]

Multipole expansion
Chapter *Potentials*, Section 4, Problems 27-29,35,52 [1]

2 Electric Field in Matter

2.1 Concept of polarization

Chapter *Electric Field in Matter*, Section 1 & 2, Problems 10-13,33 [1]

2.2 Electric displacement

Chapter *Electric Field in Matter*, Section 3, Problems 15,16 [1]

2.3 Linear dielectrics

Chapter *Electric Field in Matter*, Section 4, Problems 18,20,22,24 [1]

3 Magnetostatics

3.1 Magnetic field and its differentiation

Chapter *Magnetostatics*, Section 1, 2 & 3, Problems 4,5,8,10,11,14-17,45,46 [1]

3.2 Magnetic vector potential

Chapter *Magnetostatics*, Section 4, Problems 23-27,35,36 [1]