**KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS**

PHYSICS DEPARTMENT

Electricity and Magnetism I (Phys 305)

Spring (Second Semester) 2022

(Term 212)

**Instructor** Dr. Abdelkarim Mekki

**Office number** Bldg. 6/Room 219

**Phone number** 4292

**E-mail** akmekki@kfupm.edu.sa

**Office hours:** UTR 11:00 to 11:50 am.

**Course Number**  PHYS 305

**Course Title** Electricity and Magnetism I

**Catalog Course Description**: Electrostatics; Laplace and Poisson's equations; Dielectric media, Magnetostatics and magnetic fields in matter; electrodynamics

**Pre-Requisites** PHYS 102, MATH 201, PHYS 210 or MATH 208 or MATH 333

**Textbook**  Introduction to Electrodynamics by David J. Griffiths, 4 edition

**Grading Policy** Quizzes 20%

 Major1 25%

 Major2 25%

 Final 30%

**Important information:**

* Please be on time for the lectures. Presentations and class discussions are very important parts of the course.
* The class syllabus might change slightly.
* Please try to read the material before coming to the lecture.
* Group work and discussion is strongly encouraged, but the written and presented work should be absolutely each students work unless stated.
* Information regarding the course will be communicated through Blackboard and MS Teams.
* Keep track to what I post on the course website.
* Generally, there will be a quiz at the end of every chapter.

**Course Learning outcomes:**

1. Understand and be able to apply vector analysis needed for electrodynamics
2. Understand and be able to solve problems of electrostatics in vacuum and in conductors
3. Use method of images, separation of variables and multipole expansion to solve problems in electrostatics in vacuum and conductors
4. Understand and be able to solve problems of electrostatics in matter
5. Understand and be able to solve problems of magnetostatics in vacuum
6. Understand and be able to solve problems of magnetostatics in matter
7. Understand and be able to solve problems related to electromotive force, electromagnetic induction, and displacement currents

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| **Tentative Syllabus** |
| **Week** | **Topics** |
| **1** | **Ch.1**, 1.1-1.4 Vector algebra, Differential calculus, Integral calculus. |
| **2** | **Ch.1**, 1.4-1.6 Curvilinear coordinates, The Dirac delta function, The theory of vector fields. |
| **3** | **Ch.2**, 2.1-2.3 Electric field, Divergence and Curl of fields, Electric potential. |
| **4** | **Ch.2**, 2.4-2.5 Work & energy, Conductors, Capacitors.  |
| **5** | **Ch.3**, 3.1 Laplace equation |
| **6** | **Ch.3**, 3.2 The method of Images |
| **7** | **Ch.3**, 3.3-3.4 Separation of variables, Multipole expansion |
|  | **Major exam1 (chapters 1 to 3.2)** |
| **8** | **Ch. 4**.1-4.2 Polarization, The field of a polarized object  |
| **9** | **Ch. 4**.3-4.4 Electric displacement, Linear dielectrics |
| **10** | Capacitors continues; introduction to magnetism. |
| **11** | **Ch. 5**.1-5.2 Lorentz Force, Biot-Savart law.  |
| **12** | **Ch. 5**.3-5.4 The divergence and curl of B, Magnetic vector potential. |
|  | **Major exam2 (chapters 3.3 to 5.2)** |
| **13** | **Ch. 6**.1-6.2 Magnetization, The field of a magnetic object. |
| **14** | **Ch. 6**.3-6.4 The auxiliary H field; Linear and non-linear media. |
| **15** | **Ch. 7**.1-7.3 Electromotive force, Electromagnetic induction, Maxwell’s equations. |
|  | **Final exam (comprehensive)** |