King Fahd University of Petroleum and Minerals
Physics Department
PHYS 305 – Electricity and Magnetism I
Semester 211 – Fall 2021

Instructor: Dr. Muhammad Baseer Haider (Office 6-143)

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Course Description

Introduction to classical electromagnetic theory based on vector calculus. Electrostatics; Laplace and Poisson's equations; Dielectric media and magnetostatic fields in matter.

Learning Outcomes

1. Apply vector analysis appropriate to electrodynamics.

2. Solve electrostatics problems in vacuum, dielectrics and conductors.

3. Understand the concept of potential with the methods of images, separation of variables and multipole expansion.

4. Solve magnetostatics problems in vacuum and materials.

Prerequisites

MATH 202 and PHYS 102

Textbook Introduction to Electrodynamics,

By D. J. Griffiths, 4th edition, Cambridge University Press (2017)

Grading

Homework		15 %
Quizzes		15 %
Exam I	Chapters 1,2	20 %
Exam II	Chapters 3,4	20 %
Final Exam	Comprehensive	30 %

Exam Dates Exam 1: Sunday, 11Oct 2021

Exam 2: Sunday, 15 Nov 2021

Final Exam: TBA (22Dec2021 – 03Jan 2022)

PHYS 305 – Term 211 – Fall 2021– Lecture Schedule			
Date	**Week**	**Chap**	**Topics**
29-Aug 31 2-Sep	1	1	Vector algebra, the gradient, the del operator, the divergence, the curl, product rules, second derivatives, line, surface, volume integrals, fundamental theorems of gradient, divergence & curl, integration by parts, curvilinear coordinates, Dirac delta function, vector fields
5 7 **9**	2		
12 14 16	3		
19 21 23	4	2	The electric field, Gauss law, divergence and curl of the electric field, applications of Gauss's law, electric potential, Poisson and Laplace equations, potential of localized distributions, boundary conditions, energy and work in electrostatics, conductors: basic properties, induced charge, surface charge, capacitors
26 28 30	5		
3-Oct 5 7	6		
10	7	3	**11Oct 2021 -Exam 1**
12 14			Laplace's equation, the method of images, separation of variables: Cartesian & spherical coordinates, multipole expansions: large distances, monopole & dipole terms, Multipole expansions: origin of coordinates, dipole field
17	8		**HOLIDAY**
19 21			Laplace's equation, the method of images, separation of variables: Cartesian & spherical coordinates, multipole expansions: large distances, monopole & dipole terms, Multipole expansions: origin of coordinates, dipole field
24 26 28	9		
31 2-Nov 4	10	4	constant, boundary value problems with dielectrics, energy inPolarization, bound charges, field inside dielectrics, electric displacement, Gauss law, susceptibility, permittivity, dielectric dielectric systems, forces on dielectrics
7 9 11	11		
14	12	5	**15 Nov 2021 - Exam 2**
16 18			Magnetic fields, magnetic force, currents, Biot-Savart law, divergence and curl of B, Ampere's law, magnetic vector potential, boundary conditions, multipole expansions
21 23 25	13		
28 30 2-Dec	14		**Spring Break**
5 7 9	15		
12 14 16	16	6	Torque and force on magnetic dipoles, effect of B on atomic orbits, magnetization, bound currents, the auxiliary field, linear and nonlinear media, ferromagnetism
19 20	17		
Final Exam TBA (22 Dec 2021 - 03 Jan 2022)			