COURSE AND INSTRUCTOR INFORMATION

Course: PHY 430 (Electricity and Magnetism)
Lecture Location: Schmucker Science North (SSN) 191
Lecture Time: MWF: 11:00 am – 11:50 am
Instructor: Anil K. Kandalam (Dr. Kandalam or Dr. K)
Office Location: Schmucker Science South, SS 403A
Email: akandalam@wcupa.edu
Office Hours: M, W, F: 9:00 am – 10:00 am, Thursday: 12:00 noon – 2:00 pm

COURSE DESCRIPTION

This course is a course in electricity and magnetism designed for undergraduates at the junior or senior level. Topics to be covered include electrostatics, electric potentials, electric fields, magnetostatics, magnetic fields, and electrodynamics through Maxwell's equations.

COURSE MATERIALS

Textbook: *Electricity and Magnetism*, Edward M. Purcell and David J. Morin (**Third Edition**)

Supplemental Texts: *Div, Grad, Curl, and All That: An informal Text in Vector Calculus*, H. M. Schey
Introduction to Electrodynamics, David J. Griffiths

EXPECTATIONS

This is a challenging course. Given the complexity of the ideas and concepts in this course as well as the required mathematical background, you will have to put in a substantial amount of effort. You cannot rely on your time in class and the associated lectures alone to master the topics presented. You will have to spend a great deal of time outside class reading the material covered in the text, studying the examples provided, and working on the problem sets. If you have not done this up to now in your other classes please be forewarned. Don't hesitate to ask me or other professors for help in the material that you have trouble understanding.

COURSE COMPONENTS

Pre-class Reading: You must read before coming to the class. Since, we have limited lecture time, we must focus on the more challenging concepts in the course. Thus, it is critical that you come to lecture knowing the basic elements which we will build on in lecture that day.

Lecture: I attempt to make the lecture as informal as possible. I encourage lots of questions.

Problem Sets: There will be one problem set each week (except during the exam weeks). Working the problem sets is very important for mastering this subject. Generally, they will be given out on Mondays and due the following week's Wednesday in class.

EVALUATION

The final grade for this course will be based on the following:

- Problem Sets ……20%
- Exams (3 @ 20% each)……60%
- Final exam……..20%

Letter grades will be assigned on the following scale. However, I reserve the right to adjust the weights of individual components, or the scale to account for unforeseen circumstances.

93 – 100 %	A	73 – 76 %	C
90 – 92 %	A–	70 – 72 %	C–
87 – 89 %	B+	67 – 69 %	D+
83 – 86 %	B	63 – 66 %	D
80 – 82 %	B–	60 – 62%	D–
77 – 79 %	C+	59% or lower	F

GRADING COMPONENTS AND POLICIES

Problem Sets: You are encouraged to work together/collaborate on problem sets, but the work that you hand in must be your own and must reflect your own understanding of the material. The best balance between working alone and working with other people is to (i) first work on the problem sets alone. If you are stuck on a problem, then (ii) work with other students and then (iii) complete the problem alone where you can collect your thoughts in peace. Make sure that you understand the solution to each problem that you turn in. If step (ii) does not help, you can always get hints from me during my office hours. Please do not ask from help/hints via. e-mail. Please indicate the names of people you have collaborated with for a problem set.

Regular Exams: There are a total of three exams that will be given in the semester. Two of these exams are in-class, while one exam is a take-home exam. No grades will be dropped and there are no-make up exams. The exceptions, however, are limited to the absences related to University Sanctioned Events (see below). If you miss an exam for a University Sanctioned Event you must notify me in advance so that we can arrange for you to take the exam in a manner consistent with its integrity. You must also provide some form of documentation (performing arts program, competition schedule etc.

Final Exam: The final exam is a cumulative exam and is MANDATORY.

CONTACT POLICY

Please include ***PHY430*** in the subject line of any e-mail. I try to respond to e-mail within 24hrs. Although I will try to answer all questions directed to me by e-mail, most problems related to course content are best discussed during office hours.

ELECTRONIC DEVICES POLICY

In order to create a conductive learning environment, please arrange for all electronic devices to be set in silent/vibrate mode and put away. If you need to use a device to accommodate a disability, please see below. If I see anyone **texting or using their cell phones** during the class, I will take 5 points off of the nearest exam grade, and you will be considered "absent" for that day, since you are obviously not mentally present.

DISABILITY STATEMENT

If you have a disability which will require special accommodation, please meet with me as soon as possible to discuss your needs. Also, contact the Office of Services for Students with Disabilities (OSSD) at (610) 436-3217. Sufficient notice is needed in order to make the accommodations possible. Both the WCU and I desire to comply with the ADA of 1990.

ACADEMIC INTEGRITY & CONDUCT

I have a zero tolerance policy for breaches of academic integrity. Breaches of academic integrity will be investigated and sanctions imposed to the full extent available under University policy. For questions regarding the university Academic Dishonesty, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to their major department's handbook, the Undergraduate Course Catalogue, the Rams Eye View, or the University Web Site. Please understand that improper conduct in any of these areas will not be tolerated and may result in immediate ejection from the class.

UNIVERSITY SANCTIONED EVENTS

If you are participating in a University sanctioned event during one of our scheduled exams you must notify me in advance. You must provide some form of documentation. We can then arrange for you to take the exam in a manner consistent with exam integrity. For details please see the discussion of University Sanctioned Events in the WCU undergraduate catalog.

PUBLIC SAFETY

The Emergency Communications Committee recommends that the number of WCU's Department of public safety be available on every course syllabi. WCU Department of Public Safety: (610) 436-3311.

COURSE SCHEDULE

The general plan for this course is as follows: We will use E & M, Purcell and Morin (3rd Edition) and cover the following: Chapters 1 – 3, parts of chapters 4 and 5, Chapters 6 – 9, and parts of chapters 10 & 11. Sometimes, problems and discussion will be augmented with materials from Introduction to Electrodynamics by Griffiths.

Following is a tentative lecture outline for this course. I reserve the right to adjust this schedule as necessary during the semester to ensure a satisfactory learning experience.

	Date		Topic	Reading
1	F	Jan. 24	Coulomb's Law, Energy of a system of Charges	1.1 – 1.5
2	M	Jan. 27	The Electric Field, $\boldsymbol{E}$; Charge Distributions	1.6 – 1.8
3	W	Jan. 29	Gauss's Law and its applications in calculating $\boldsymbol{E}$	1.9 – 1.12
4	F	Jan. 31	Application of Gauss's Law in calculating $\boldsymbol{E}$	1.12 – 1.13
5	M	Feb. 3	Energy associated with electric Field	1.14 – 1.16
6	W	Feb. 5	Electric Potential ϕ; Gradient, $\boldsymbol{E} = -\nabla\phi$	2.1 – 2.4
7	F	Feb. 7	Potential of a localized charge distribution	2.5 – 2.6
8	M	Feb. 10	Divergence of a Vector Field, Gauss's Law in differential form	2.8 – 2.10
9	W	Feb. 12	Application of Gauss's Law in Differential Form	2.8 – 2.10
10	F	Feb. 14	Poisson's and Laplace's Equations	2.11 – 2.13
11	M	Feb. 17	Curl of a Vector Field, Stokes' Theorem	2.14 – 2.17
12	W	Feb. 19	$\boldsymbol{E}$-fields around conductors, Uniqueness theorem	3.1 – 3.3
13	F	Feb. 21	Method of images with examples	3.4
14	M	Feb. 24	Solutions to Laplace's Equation using separation of variables	**G 3.3**
15	W	Feb. 26	Multipole Expansion	2.7, **G 3.4**
16	F	Feb. 28	Electric Currents, Current Density, and Steady Currents	4.1 – 4.2
17	M	Mar. 3	Electrical Conductivity and Ohm's Law	4.3 – 4.4
18	W	Mar. 5	Conduction in metals and Semiconductors	4.5 – 4.6

	Date		Topic	Reading
	F	Mar. 7	**TEST 1: Chapters 1 – 3**	
19	M	Mar. 10	Magnetic Forces, Force on a Moving Charge	5.2 , 5.8
20	W	Mar. 12	Interaction between moving charges, Magnetic Field	5.9, 6.1 – 6.2
21	F	Mar. 14	Vector Potential, Calculating ***B*** fields	6.3 – 6.6
	M W F	Mar. 17 Mar. 19 Mar. 21	**SPRING BREAK**	
22	M	Mar. 24	Calculating ***B*** fields	6.3 – 6.6
23	W	Mar. 26	Electromagnetic Induction, motion of conductors through B fields	7.1 – 7.4
24	F	Mar. 28	Inductance and Energy stored in a Magnetic Field **TEST 2: Chapters 4 – 6 (Take Home Exam)**	7.5 – 7.8
25	M	Mar. 31	"Something is missing", Displacement Current,	9.1 – 9.2
26	W	Apr. 2	Maxwell's Equations; EM Waves and their velocity	9.3 – 9.5
27	F	Apr. 4	Energy Transport by EM Waves	9.6
28	M	Apr. 7	Electric Fields in matter: Dielectrics; Induced Dipoles	10.1 – 10.3
29	W	Apr. 9	Torque on a dipole in an external field	10.4 – 10.6
30	F	Apr. 11	Electric Field due to a Polarized material	10.7, 10.9
31	M	Apr. 14	Gauss's Law in the presence of Dielectrics	10.10 – 10.11
32	W	Apr. 16	Electric Displacement Vector	10.11
33	F	Apr. 18	Bound Charge Current, EM wave in a dielectric	10.12 – 10.15
34	M	Apr. 21	Dia-, Para-, and Ferromagnetism; Field of a current loop	11.1 – 11.3
35	W	Apr. 23	Force on Magnetic Dipole	11.4
36	F	Apr. 25	**TEST 3: Chapters 9 – 10**	
37	M	Apr. 28	Electric Currents in Atoms; Electron Spin and Magnetic Moment	11.5 – 11.6
38	W	Apr. 30	Magnetic Susceptibility; Field of a Magnetized Object	11.7 – 11.8
39	F	May 2	Free Currents and the field H	11.10
40	M	May 5	Ferromagnetism	11.11