

## **COURSE AND INSTRUCTOR INFORMATION**

**Course:** PHY 430 (Electricity and Magnetism)

**Lecture Location:** Schmucker Science North (SSN) 191

**Lecture Time:** MWF: 1:00 pm – 1:50 pm

**Instructor:** Anil K. Kandalam (Dr. Kandalam or Dr. K)

**Office Location:** Schmucker Science South, SS 403A

**Email:** akandalam@wcupa.edu

**Office Hours:** Monday, Wednesday: 2:00 pm – 3:00 pm

Tuesday: 10:00 am – 12:00 noon

Friday: 9:00 am – 10:00 am or by appointment

## **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:** *Introduction to Electrodynamics*, David J. Griffiths (4<sup>th</sup> Edition)

**Supplemental Texts:** *Div, Grad, Curl, and All That: An informal Text in Vector Calculus*, H. M. Schey

## **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 questions during the lecture.

**Problem Sets:** There will be one problem set almost every week. Generally, they will be given out on Mondays and due the following week's Wednesday in class. **No late problem sets will be accepted.** Working the problem sets is very important for mastering this subject. All problem sets will be graded (*to varying degrees*) and returned the following week (typically during Monday class time). If you fail to turn in a problem set because of absences (excused or unexcused) then you will receive a zero for the problem set grade. **The problem sets will be graded only roughly.** It is your responsibility to check your work with the solution set.

## 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. **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.). If you miss the exam for any other reason the same rules apply, and it must be a very good reason (sickness, death, and dismemberment qualify).

**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.

## 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. It is the responsibility of each student to adhere to the university's standards for academic integrity. Violations of academic integrity include any act that violates the rights of another student in academic work, that involves misrepresentation of your own work, or that disrupts the instruction of the course. Other violations include (but are not limited to): cheating on assignments or examinations; plagiarizing, which

means copying any part of another's work and/or using ideas of another and presenting them as one's own without giving proper credit to the source; selling, purchasing, or exchanging of term papers; falsifying of information; and using your own work from one class to fulfill the assignment for another class without significant modification. Proof of academic misconduct can result in the automatic failure and removal from this course. For questions regarding Academic Integrity, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to the Department Undergraduate Handbook, the Undergraduate Catalog, the *Ram's Eye View*, and the University website at [www.wcupa.edu](http://www.wcupa.edu).

### **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. Students are advised to carefully read and comply with the excused absences policy, including absences for university-sanctioned events, contained in the WCU Undergraduate Catalog. In particular, please note that the "responsibility for meeting academic requirements rests with the student," that this policy does not excuse students from completing required academic work, and that professors can require a "fair alternative" to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

### **COURSE SCHEDULE**

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	M Jan. 22	The Coulomb's Law and Charge Distributions	2.1.1 – 2.1.2
2	W Jan. 24	Energy of a system of point charges	2.4.1 – 2.4.2
3	F Jan. 26	The Electric Field, $\mathbf{E}$ ; A few examples	2.1.3 – 2.1.4
4	M Jan. 29	Surface Integral, Electric Flux, and Gauss's Law in integral form	1.3.1, 2.2.1, 2.2.2
5	W Jan. 31	Applications of Gauss's Law	2.2.3
6	F Feb. 2	Electric Potential $V$ , Gradient, $\mathbf{E} = -\nabla V$	2.3.1, 2.3.2
7	M Feb. 5	The Potential of a Localized charge distribution	2.3.4
8	W Feb. 7	Divergence of a vector function, Gauss's law in differential form	1.2.4, 2.2.1
9	F Feb. 9	Curl of a Vector Field, Stokes' Theorem	1.2.5, 1.3.5, 2.2.4
10	M Feb. 12	$\mathbf{E}$ -fields around conductors, Induced Charges	2.5.1 – 2.5.3
11	W Feb. 14	Capacitors	2.5.4
12	F Feb. 16	Poisson's and Laplace's equations	3.1.1 – 3.1.4
13	M Feb. 19	Uniqueness theorem and Earnshaw's theorem	3.1.5, 3.1.6
14	W Feb. 21	Method of Images with examples	3.2
	F Feb. 23	<b>EXAM – I: Chapters 1 &amp; 2</b>	
15	M Feb. 26	Solutions to Laplace's equations with separation of variables	3.3
16	W Feb. 28	Solutions to Laplace's equations with separation of variables	3.3
17	F Mar. 2	Multipole Expansion	3.4
18	M Mar. 5	Electric Fields in Matter: Dielectrics and Induced Dipoles	4.1.1 – 4.1.3
19	W Mar. 7	Torque on a dipole in an external field, Polarization	4.1.3 – 4.1.4
20	F Mar. 9	Electric field due to a Polarized Material, Bound Charges	4.2
	M Mar. 12 W Mar. 14 F Mar. 16	<b>SPRING BREAK</b>	

	Date		Topic	Reading
21	M	Mar. 19	Electric Displacement Vector	4.3
22	W	Mar. 21	Linear Dielectrics	4.4
23	F	Mar. 23	The Lorentz Force Law	5.1
24	M	Mar. 26	The Biot-Savart Law	5.2
25	W	Mar. 28	Applications of Biot-Savart Law	5.2
26	F	Mar. 30	The Curl and Divergence of $\mathbf{B}$ , Ampere's Law	5.3.1 – 5.3.2
27	M	Apr. 2	Applications of Ampere's Law	5.3.3
	W	Apr. 4	<b>EXAM – II: Chapters 3 &amp; 4</b>	
28	F	Apr. 6	The Magnetic Vector Potential	5.4.1
29	M	Apr. 9	Multipole Expansion of the Vector Potential	5.4.2
30	W	Apr. 11	Magnetic Fields in Matter: Force and Torque on Magnetic Dipole	6.1.1 – 6.1.3
31	F	Apr. 13	Effect of a magnetic field on Atomic Orbits	6.1.3
32	M	Apr. 16	Field of a Magnetized Object	6.2
33	W	Apr. 18	The Auxiliary Field, $\mathbf{H}$	6.3
34	F	Apr. 20	Electromotive Force	7.1.1 – 7.1.3
35	M	Apr. 23	Electromagnetic Induction: Faraday's Law & Induced $\mathbf{E}$ field	7.2.1, 7.2.2
36	W	Apr. 25	Electromagnetic Induction: Inductance, Energy in $\mathbf{B}$ Fields	7.2.3, 7.2.4
	F	Apr. 27	<b>EXAM – III: Chapters 5 &amp; 6</b>	
37	M	Apr. 30	Maxwell's Equations	7.3
38	W	May 2	Maxwell's Equations	7.3
39	F	May 4	Maxwell's Equations	7.3
<b>FINAL EXAM: FRIDAY, MAY 11, 2018; 10:30 AM – 12:30 PM</b>				

### **STUDENTS WITH DISABILITIES**

If you have a disability that requires accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about West Chester University's Services for Students with Disabilities (OSSD), please visit them at 223 Lawrence Center. The OSSD hours of Operation are Monday – Friday, 8:30 a.m. – 4:30 p.m. Their phone number is 610-436-2564, their fax number is 610-436-2600, their email address is ossd@wcupa.edu, and their website is at [www.wcupa.edu/ussss/ossd](http://www.wcupa.edu/ussss/ossd).

### **E-MAIL POLICY STATEMENT**

It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.

### **TITLE IX STATEMENT**

West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment and to comply with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator, Ms. Lynn Klingensmith. The only exceptions to the faculty member's reporting obligation

are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University protection of minors policy. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at the webpage for the Office of Social Equity at [http://www.wcupa.edu/\\_admin/social.equity/](http://www.wcupa.edu/_admin/social.equity/).

### **EMERGENCY PREPAREDNESS**

All students are encouraged to sign up for the University's free WCU ALERT service, which delivers official WCU emergency text messages directly to your cell phone. For more information, visit [www.wcupa.edu/wcualert](http://www.wcupa.edu/wcualert). To report an emergency, call the Department of Public Safety at 610-436-3311.