

## **COURSE AND INSTRUCTOR INFORMATION**

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

**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 (via Zoom only):** Monday, Wednesday: 1:00 pm – 3:00 pm

Tuesday: 9:00 am – 11:00 am, Friday: 1:00 pm – 2:00 pm

Schedule zoom appointment during one of the posted times using the link:

[https://calendly.com/anil\\_k\\_kandalam](https://calendly.com/anil_k_kandalam)

## **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)

## **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 for help in the material that you have trouble understanding.

## **COVID-19 STATEMENT**

Part of West Chester University's response to the COVID-19 pandemic was to switch the vast majority of instruction to remote. This decision was made out of an abundance of caution to protect the health of all members of the WCU community. Faculty have been asked to make every effort to adapt their courses to this novel situation while still meeting the critical learning outcomes of the course. Students are asked to discuss any problems with the new course format and schedule directly with their instructors. Patience and flexibility on everyone's behalf are critical to our community's navigation of this public health crisis.

*For this particular course, the following alternative modalities are being utilized:*

- 1) Most of the lectures will be held live through zoom during the *posted lecture times MWF (11 – 11:50 am)* for this course.
- 2) For few lectures (topics), I will post pre-recorded lectures on D2L. Students are required to watch these videos. For any questions on these pre-recorded lecture videos, students must email me to set up a zoom office meeting.

## 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:** Most of the lectures will be taught live via zoom. **I will send you a zoom link on Friday, 21<sup>st</sup>, August 2020.** 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 assigned on Mondays and due the following week's Wednesday by 4 pm (EST). **A large fraction of the learning in this course takes place working on these homework problems, so it is essential that you put a substantial effort into these assignments.**

**Late work cannot be accepted except by prior arrangement with the instructor.** Working to deadlines is an aspect of personal responsibility and, as such, it is an important skill to develop. All problem sets will be graded (*to varying degrees*) and returned the following week (typically in a week). 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) Give each problem a good try on your own first. If you get stuck, reread the relevant section of the text and review your notes and try it again. If you're still stuck, 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 for help/hints via e-mail. Please indicate the names of people you have collaborated with for a problem set.**

**Do not refer to previous years' solutions as several problems were used previously.**

**Here's a handy rule of thumb:** if you can do the problem without referring to any notes, then you understand the concept and the problem-solving approach. Try a similar problem and prove it to yourself.

You must upload *a scanned copy of your handwritten work* onto D2L.

**Upload instructions:** On your course D2L page, click on **Assessments** link on the top left. From the dropdown menu, select: **Assignments**. You will see the list of assignments and their completion status. For example, for homework#1, you will see “**Not Submitted**” link under completion status. Click on “Not Submitted” to upload your scanned homework in PDF format (**only**).

If you use a tablet/iPad to do your homework, please convert it to a PDF and upload the file onto D2L using the above instructions.

If you do homework on a paper, you must use an App on your phone and cover it to a PDF. There are several options (**given on the last page of this syllabus document**) to convert your handwritten homework to PDF. **I will not accept “pictures” of your homework taken with your cellphone.**

**Regular Exams:** There are a total of three exams that will be given in the semester. Two of these exams will be given during the regular class time (50 minutes). I will post the exam on D2L at least 10 minutes before the start of the exam. During the exam, you must login into zoom and must have the webcam of your computer/laptop/Tablet pointed directly towards your desk (not pointing towards your face) where you write the exam. **After completing the exam, you must scan your handwritten exam and upload it onto D2L as a single PDF. I will give you 15 minutes to scan and upload the exam and it won't be counted towards your exam time.**

**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. During the final exam, you must login into zoom and must have the webcam of your computer/laptop/Tablet pointed directly towards your desk (not pointing towards your face) where you write the exam. After completing the exam, you must scan your handwritten final exam and upload it onto D2L as a single PDF. I will give you 15 minutes to scan and upload the exam and it won't be counted towards your exam time.

## **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 (*via zoom*).

## **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)

### **EXECUSED ABSENCES POLICY**

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.

### **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. Their phone number is 610-436-2564, their fax number is 610-436-2600, their email address is [ossd@wcupa.edu](mailto:ossd@wcupa.edu), and their website is at <https://www.wcupa.edu/universityCollege/ossd/>. In an effort to assist students who either receive or may believe they are entitled to receive accommodations under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, the University has appointed a student advocate to be a contact for students who have questions regarding the provision of their accommodations or their right to accommodations. The advocate will assist any student who may have questions regarding these rights. The Director for Equity and Compliance/Title IX Coordinator has been designated in this role. Students who need assistance with their rights to accommodations should contact them at 610-436-2433.

### **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.

### **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.

**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	Aug. 24	The Coulomb's Law and Charge Distributions	2.1.1 – 2.1.2
2	W	Aug. 26	Energy of a system of point charges	2.4.1 – 2.4.2
3	F	Aug. 28	The Electric Field, $E$ ; A few examples	2.1.3 – 2.1.4
	M	Aug. 31	Surface Integral, Electric Flux, and Gauss's Law in integral form	1.3.1, 2.2.1, 2.2.2
4	W	Sept. 2	Applications of Gauss's Law	2.2.3
5	F	Sept. 4	Electric Potential $V$ , Gradient, $E = -\nabla V$	2.3.1, 2.3.2
6	M	Sept. 7	<b>NO CLASS – LABOR DAY</b>	
7	W	Sept. 9	The Potential of a Localized charge distribution	2.3.4
8	F	Sept. 11	Divergence of a vector function, Gauss's law in differential form	1.2.4, 2.2.1
9	M	Sept. 14	Curl of a Vector Field, Stokes' Theorem	1.2.5, 1.3.5, 2.2.4
10	W	Sept. 16	$E$ -fields around conductors, Induced Charges	2.5.1 – 2.5.3
11	F	Sept. 18	Capacitors	2.5.4
12	M	Sept. 21	Poisson's and Laplace's equations	3.1.1 – 3.1.4
13	W	Sept. 23	Uniqueness theorem and Earnshaw's theorem	3.1.5, 3.1.6
14	F	Sept. 25	<b>EXAM – I: Chapters 1 &amp; 2</b>	
	M	Sept. 28	Method of Images with examples	3.2
15	W	Sept. 30	Solutions to Laplace's equations with separation of variables	3.3
16	F	Oct. 2	Solutions to Laplace's equations with separation of variables	3.3
17	M	Oct. 5	Solutions to Laplace's equations with separation of variables	3.3
18	W	Oct. 7	Multipole Expansion	3.4
19	F	Oct. 9	Multipole Expansion	3.4
20	M	Oct. 12	Electric Fields in Matter: Dielectrics and Induced Dipoles	4.1.1 – 4.1.3
21	W	Oct. 14	Torque on a dipole in an external field, Polarization	4.1.3 – 4.1.4
22	F	Oct. 16	Electric field due to a Polarized Material, Bound Charges	4.2
23	M	Oct. 19	Electric Displacement Vector	4.3
24	W	Oct. 21	Linear Dielectrics	4.4
25	F	Oct. 23	The Lorentz Force Law	5.1
26	M	Oct. 26	The Biot-Savart Law	5.2
	W	Oct. 28	<b>EXAM – II: Chapters 3 &amp; 4</b>	
27	F	Oct. 30	Applications of Biot-Savart Law	5.2
28	M	Nov. 2	The Curl and Divergence of $B$ , Ampere's Law	5.3.1 – 5.3.2
29	W	Nov. 4	Applications of Ampere's Law	5.3.3
30	F	Nov. 6	The Magnetic Vector Potential	5.4.1
31	M	Nov. 9	Multipole Expansion of the Vector Potential	5.4.2
32	W	Nov. 11	Multipole Expansion of the Vector Potential	5.4.2
33	F	Nov. 13	Magnetic Fields in Matter: Force and Torque on Magnetic Dipole	6.1.1 – 6.1.3
34	M	Nov. 16	Effect of a magnetic field on Atomic Orbits	6.1.3
35	W	Nov. 18	Field of a Magnetized Object	6.2
36	F	Nov. 20	The Auxiliary Field, $H$ ; Electromotive Force	6.3, 7.1.1 – 7.1.3
	M	Nov. 23	<b>THANKSGIVING BREAK</b>	
	W	Nov. 25		
	F	Nov. 27		
37	M	Nov. 30	Electromagnetic Induction: Faraday's Law & Induced $E$ field	7.2.1, 7.2.2
38	W	Dec. 2	Electromagnetic Induction: Inductance, Energy in $B$ Fields	7.2.3, 7.2.4
			<b>TAKE HOME EXAM – III: Chapters 5 &amp; 6</b>	
39	F	Dec. 4	Maxwell's Equations	7.3
40	M	Dec. 7	Maxwell's Equations	7.3
<b>FINAL EXAM: FRIDAY, DECEMBER 11, 2020; 10:30 AM – 12:30 PM</b>				

## **REPORTING INCIDENTS OF SEXUAL VIOLENCE**

West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to comply with the requirements of Title IX of the Education Amendments of 1972 and the University's commitment to offering supportive measures in accordance with the new regulations issued under Title IX, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. 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: [https://www.wcupa.edu/\\_admin/diversityEquityInclusion/sexualMisconduct/default.aspx](https://www.wcupa.edu/_admin/diversityEquityInclusion/sexualMisconduct/default.aspx)

## **DIFFERENT OPTIONS TO CONVERT HANDWRITTEN NOTES TO PDF**

### **OPTION #1 - Use an APP on your phone**

- *Adobe Scan* is an app for your phone that can take pictures and turn them into a PDF document. Here is more information about the Adobe Scan [free](#) app ...

<https://acrobat.adobe.com/us/en/mobile/scanner-app.html>

- CamScanner (<https://www.camscanner.com/>)

### **OPTION #2 - Scanning Documents on the Notes App (\*\* iPhone Users Only \*\*)**

SOURCE: Dr. KEVIN APTOWICZ

- 1) Open the Notes app on your iPhone.
- 2) Tap the icon in the bottom right to create a "new note".
- 3) At the bottom of the screen, press the camera icon.
- 4) Select "Scan Documents".
- 5) It will go to the camera screen. Place the full page of your document under the camera. **Make sure there is enough light on the document, so the camera picks up every word.**
- 6) Press the white button to scan each page. Multiple pages can be scanned.
- 7) Save the note. Send the note to your email.
- 8) Download the file from the email onto a computer. Upload the file from the computer to D2L and submit.