

## **COURSE AND INSTRUCTOR INFORMATION**

**Course:** PHY 480: Solid State Physics

**Lecture Location:** Schmucker Science North 192

**Lecture Time:** Tuesday, Thursday: 11:00 am – 12:15 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: 9:00 am – 11:00 am

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

## **COURSE OBJECTIVE**

This course is an introductory solid state physics course. The goal is for you to acquire a firm grasp of the fundamental topics in solid state physics, such as classical theory of conduction in metals, the free electron theory, chemical bonding in solids, crystal vibrations and phonons; crystal structure, reciprocal lattices, and behavior of electrons in solids (periodic potentials and band structure), and if time permits, magnetism in solids.

## **REQUIRED COURSE MATERIALS**

**Textbook:** *The Oxford Solid State Basics*, Steven H. Simon (Oxford University Press)

**Reference books for additional reading:**

*Introduction to Solid State Physics*, Charles Kittel (Wiley)

*Solid State Physics*, Ashcroft and Mermin (Brooks Cole)

*Solid State Physics*, A. J. Dekker (Prentice-Hall)

## **COURSE COMPONENTS**

**Lecture:** I attempt to make the lecture as informal as possible. I encourage questions during the class.

**Problem Sets:** Problems will be assigned almost once a week. They are due by 4:00 pm on the due date. At 4:00 pm, the solutions will be posted on the webpage. **No late problem sets will be accepted.** Working the problem sets is very important for mastering this subject. 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. 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%

I will be using the official WCU scale of grades, see p.92 in the undergraduate catalog (2015-2016).

However, I reserve the right to adjust the weights of individual components, or the scale to account for unforeseen circumstances.

## **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. It is likely that your work will look similar to that of classmates with whom you worked/collaborated, but if you prepare your own answers for submission there will be differences in how you express your results. **If you just copy someone else's homework answers and/or copy from instructors' solutions manual (available to you in hard copy or you/someone else found it online), it amounts to violation of academic integrity.**

Finally, please staple your homework before you submit it, and cut off any "scruff" from spiral notebooks.

**Regular Exams:** 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. The date and time of the final exam for this course (as set by the registrar, as of 01/18/2017) is:

**Tuesday, May 9, 2017 from 10:30 pm – 12:30 pm**

*You should plan to be available for the entire finals week.* We have in past semesters had to reschedule finals due to weather related events.

## **ATTENDANCE POLICY**

A regular attendance to the lectures is an important part of this course and I highly recommend it. This is your chance to ask questions, see examples and get help in solving problems. I am here to guide you through the material. Attendance will benefit your understanding and therefore grade. However, I do not give an attendance grade. Students must understand that they are responsible for all material covered and assigned during their absences (excused and unexcused) and that they are responsible for the academic consequences of their absences.

## **CONTACT POLICY**

Please include **PHY480** 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.

## **DISABILITY STATEMENT**

If you have a disability that requires special accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodation and meet with me as soon as possible so that I can support your success in an informed manner. Also, contact the Office of Services for Students with Disabilities (OSSD) at (610) 436-2564, their email address is [ossd@wcupa.edu](mailto:ossd@wcupa.edu), and their website is

www.wcupa.edu/ussss/ossd. Sufficient notice is needed 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. 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/Graduate Course Catalog, the *Ram's Eye View*, and the University website. 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. Students are advised to carefully read and comply with the excused absences policy for university-sanctioned events contained in the WCU Undergraduate Catalog. 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.

### **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.

### **ALL OTHER ACADEMIC POLICIES**

For any university-wide academic policy not explicitly covered in this document, such NO Grade policies, please consult your major advising handbook, the Undergraduate Catalog, the *Ram's Eye View*, or University Website.

### **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.

## **TENTATIVE SCHEDULE** (This schedule is subject to revision.)

	<b>Date</b>		<b>Topic</b>
1	T	Jan. 24	Introduction, Ch. 3: Electrons in Metals (Drude Theory)
2	R	Jan. 26	Ch. 3: Drude Theory; Ch. 4: Sommerfeld (Free Electron) Theory
3	T	Jan. 31	Ch. 4: Free Electron Theory
4	R	Feb. 2	Ch. 6: Chemical Bonding in Solids
5	T	Feb. 7	Ch. 6: Chemical Bonding in Solids
6	R	Feb. 9	Ch. 9: Vibrations in One-dimensional Monatomic Chain
7	T	Feb. 14	Ch. 9: Vibrations in One-dimensional Monatomic Chain
8	R	Feb. 16	Ch. 9: Vibrations in One-dimensional Monatomic Chain
9	T	Feb. 21	Ch. 10: Vibrations in One-dimensional Diatomic Chain
10	R	Feb. 23	Ch. 10: Vibrations in One-dimensional Diatomic Chain
11	T	Feb. 28	Ch. 11: Tight Binding Chain
12	R	Mar. 2	Ch. 11: Tight Binding Chain
13	T	Mar. 7	Ch. 12: Crystal Structure
14	R	Mar. 9	<b>TEST 1 (Ch. 3 – 9)</b>
	T	Mar. 14	<b>SPRING BREAK</b>
	R	Mar. 16	
15	T	Mar. 21	Ch. 12: Crystal Structure
16	R	Mar. 23	Ch. 12: Crystal Structure
17	T	Mar. 28	Ch. 13: Reciprocal Lattice
18	R	Mar. 30	Ch. 13: Brillouin Zones
19	T	Apr. 4	Ch. 13: Brillouin Zones
20	R	Apr. 6	Ch. 15: Electrons in a Periodic Potential <b>(Take Home exam: TEST 2, Ch. 10 - 13)</b>
21	T	Apr. 11	Ch. 16: Energy Bands in One dimension
22	R	Apr. 13	Ch. 16: Energy Bands in Two and Three dimensions
23	T	Apr. 18	Ch. 16: Band Structure and Optical Properties
24	R	Apr. 20	Ch. 17: Electrons and Holes
25	T	Apr. 25	Ch. 17: Impurities and Doping
26	R	Apr. 27	Ch. 19: Magnetic Properties of Atoms
27	T	May 2	<b>TEST 3 (Ch. 15 – 17)</b>
28	R	May 4	Ch. 19: Magnetic Properties of Atoms