Course Syllabus – Fall 2007

Course Number and Title:  PHYS 4385: Solid State Physics

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Office Hours: M,W, F 11:00 am-12:00 am; M, W 2:00 pm-5:30 pm; T, R 1:00 pm-2:00 pm or by appt

Catalog Description: This course serves as an advanced elective for physics majors. The course will cover the physics of materials in the solid state, such as crystal properties, electron behavior, lattice behavior, energy bands, semiconductors and other materials, and simple electronic devices.

Pre-requisites: PHYS 3300 and any two 4000-level physics courses or permission of instructor. Working knowledge of calculus at the level of Math 3341. Some knowledge of multi-variable calculus and linear algebra (Math 3301, Math 2340) will be useful. You should also be comfortable with the material of Phys 2510 and Phys 2520.

Course Overview:

Solid State Physics (3 cr.) is the upper division calculus-based science course primary intended for Physics and Pre-Engineering majors. The subject of Solid State Physics is a study of mechanical, thermal, electrical and magnetic properties of various substances in condensed phase. This subject is somewhat unique, because in contrast to traditional upper division physics course where entire emphasis is placed on specific physics sub-discipline, here many sub-disciplines such as Classical Mechanics, Thermodynamics, Quantum Mechanics, Electromagnetism are interacting together in order to describe the properties of the specific class of materials, know as solid substances. Thus Solid State Physics represents the perfect illustration for practical applications of the material learned in other physics courses. Therefore this course can be considered as the applied science courses. At the same time Solid State Physics can be considered as a fundamental course for those students who are planning on the careers in Mechanical, Electrical or Chemical Engineering. It should form the basis for some even more specific courses devoted to properties of particular classes of condensed substances. As such this Solid State Physics course will consider all most common types of solid substances including traditional lattice structures, metals and semiconductors. The objective of the student is to develop the skills necessary to analyze the properties and behavior of these solid state systems based on variety of mathematical methods. These skills can be further developed in applications to more complex problems of engineering physics and quantum mechanics.
Course Objectives:

<table>
<thead>
<tr>
<th>Course objectives and goals</th>
<th>Linked to which departmental program goal(s)</th>
<th>Linked to which institutional goal(s)?</th>
<th>Types of evidence that might be used to demonstrate student achievement of objectives &amp; goals</th>
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<tbody>
<tr>
<td>Students will demonstrate conceptual understanding of the basic principles of Solid State Physics.</td>
<td>to prepare physics graduates for a wide range of career opportunities including not only graduate study in physics, engineering, pre-med, or other sciences; but also, science teaching and careers in industry and science-related business.</td>
<td>1, 2, 3, 8</td>
<td>Successful completion of the in-class essay questions during exams.</td>
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<tr>
<td>Students will demonstrate the ability to apply various mathematical methods towards solutions of applied problems in the field of Solid State Physics.</td>
<td>to prepare physics graduates for a wide range of career opportunities including not only graduate study in physics, engineering, pre-med, or other sciences; but also, science teaching and careers in industry and science-related business.</td>
<td>1, 2, 3, 8</td>
<td>Successful solving of appropriate problems during in-class discussions, homework and exams.</td>
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<td>Students will demonstrate conceptual and practical understanding of physics behind main various properties of condensed substances, such as 1) Conductivity, 2) Elasticity, 3) Heat Capacity and others.</td>
<td>to prepare physics graduates for a wide range of career opportunities including not only graduate study in physics, engineering, pre-med, or other sciences; but also, science teaching and careers in industry and science-related business.</td>
<td>1, 2, 3, 8</td>
<td>Successful completion of the essay questions during exams and solving of appropriate problems during in-class discussions, homework and exams.</td>
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Course Materials and Support:

**Required Course Materials:**


**Class Web Page:** login at [http://www.mcm.edu/~bykov.tikhon/phys4385/phys4385.html](http://www.mcm.edu/~bykov.tikhon/phys4385/phys4385.html) for supplemental information and assignments--check frequently!

**Optional or Recommended Course Materials:**

**AEC and Other Educational Support Resources:**

Your instructor is normally available at the posted office hours or by appointment. You may drop in outside regular office hours without an appointment but may be asked to come back later. You may ask questions by e-mail. This usually works fine for short questions about a specific concept or method, but do not expect that the instructor will do the whole assignment for you. Your instructor and fellow students won't be much help if they merely provide answers.
Course Policies:

Attendance:

It is understood that attendance is part of the learning commitment — placing oneself in a class setting where effective educational communication and interaction can happen. Students are expected to be regular and punctual in their attendance habits. The students who are late may not be admitted to the class room. Attendance is required and will be noted through activity participation. Any necessary absence occurring while a student is representing the University in some official way will be considered an authorized absence. Work missed due to such an absence is to be made up as the instructor determines. It is the students’ responsibility to inform the instructor about their authorized absences in advance and arrange the make-ups.

Grade Determination:

Homework: Homework is due according to the strict deadlines specified in the class schedule on the class web page and is worth 25% of the class grade. No late homework will be accepted.

In-class discussions/participation/quizzes: 15% of the class grade.

Exams: Each of the 3 Unit Exams is worth 20% of the total grade and the lowest score will be dropped. The unit exam will be given on the regular class days: September 27, October 30 and November 27. The exams may also have a take-home part. The final exam will be given during the final week. The Final Exam is comprehensive and it is also worth 20%. No make-up exams will be given unless an important reason takes place. All make-ups must be arranged in advance.

The scale for the letter grades is the following A=93-100, A-=90-92, B+=87-89, B=83-86, B-=80-82, C+=77-79, C=73-76, C-=70-72, D+=67-69, D=63-66, D-=60-62. Grades are final and cannot be negotiated unless an error has occurred. Although great care is taken in the recording of the grades, errors do occur, so please do make sure the recorded scores are correct!

Make-up Work:

All make-ups have to be authorized by instructor and arranged in advance.

+/- Grade System: See the grade scale above.

Academic Dishonesty:

Every student is fully responsible for the work which he/she submits as his/her own. Some of the class activities are designated as a group work. In these cases every group member should have the complete understanding and active participation in the group work. In some designated cases collaboration between the students is encouraged, but every student should keep in mind that this collaboration is not possible for other activities, especially during the exams. For individual assignments, presenting other people’s work as your own automatically leads to the assignment failure and may have even harder consequences up to expelling from the University.
ADA Compliance:

McMurry University abides by Section 504 of the Rehabilitation Act of 1973, which stipulates that no otherwise qualified student shall be denied the benefits of an education “solely by reason of a handicap”. If you have a documented disability that may impact your performance in this class and for which you may be requesting accommodation, you must be registered with and provide documentation of your disability to the Disability Services Office, located in Old Main Room 102. Arrangements will be made for students needing special accommodations.

Cell Phones, Calculators, and other Electronic Devices:

You must disable all audible communication devices and anything else that goes ‘beep’ or ‘ding’. In the case if these rules are violated, the student maybe asked to leave the classroom until the end of the current class period and the missed class activities will be counted as unexcused absence.

Other Course Policies:

This syllabus spells out specific policies concerning attendance, participation, assignments, deadlines and examinations; however, it is subject to change according to particular circumstances which may take place during the term. In addition to this syllabus, you have rights and responsibilities described in the Student Handbook and Schedule of Classes. Of particular importance are maintaining academic honesty and personal conduct. It is the responsibility of all members of McMurry University scholarly community to conduct themselves in a professional manner. It is also the policy of McMurry University to not discriminate on the basis of sex, sexual orientation, disability, race, color, religion, national or ethnic origin in its educational programs. This means you should not engage in behavior disruptive to the class or the learning experience of other students. You must fully participate in class which includes being seated and ready to participate in all class activities and waiting until class is over before packing up your things and leaving. During the class periods you may not read material and participate in any discussions not directly connected with the course content as well as you may not comment loud on any other subjects but physics.

Major Projects, Required Activities, and Assignments:

Solid State physics is a skills-building course, where every new topic is based on the knowledge of the previous subject. It is particularly important to attend all the lectures and to do all of the assigned homework. Mastery of a subject comes not just from the instructor or the text or the tests, but from the active engagement of every student in consideration of the concepts and methods of physics.

The specific methods designed to achieve this mastery of the subject:

- **Reading** the text and **working through** the example problems.
- **Lectures** consisting of explanations, discussions, solving example problems.
- **Homework** exercises on basic concepts and problem solving.
- **Discussions** with instructor and peers about basic principles and solving applied problems in peer groups.
- **Exams** on concepts and problem solving

Course Activities

Class Preparation: You are responsible for all of the material in the assigned reading, in handouts and exercises, presented in lecture, during discussions and posted on the class web site.
**Reading:** You are required to read the assigned sections of the text before the lecture, then you can reread them once again after the lecture. This is needed in order to spend the lecture time in the most efficient way, not by repeating again and again the facts which are presented in the book in much more detailed form than any lecture time can possible allow, but to concentrate on the most important key points of the course and clarify them for students as much as possible.

**Lecture:** Attendance and participation at all lectures is required. Lecture is an activity and should not be wasted by passivity: listen -- think -- discuss -- **ask questions** -- answer questions. The only way for me as the instructor to know how the class understands the material is by receiving questions and answering those questions, so please do ask them.

**Homework:** The assignments will be posted on the class web page. The assigned problems will be taken from the book or will be given at handouts. It will be a set problems assigned to the each block of the material, which makes 7 sets of homework during the semester. The exact deadlines are placed on the course web page. Collaboration is encouraged on the homework. However, each student should have a full understanding of any work that he/she submits as his/her own. The assignments are also open-book and open-notes.

**Online Materials and Discussions:** The online component of this class will be administrated through the software, known as the "Interactive Learning Kit" (ILK). The ILK web page is accessible through our class web site. It allows posting of handouts, online assignments and organize online forums related to the topics discussed in class. Some extra credit may be given for active participation in these activities. Each student will need to create a user account the first time when he/she uses the system and save the login and password information for future uses.

**Discussions:** There will be 7 in-class discussions and/or quizzes during the semester where you will discuss and solve problems relevant to the most important subjects of the course.

**Feedback:** At several points in the course, you will be asked to provide feedback in the form of surveys and course evaluations, to complement class discussion, assignments and exams. Please take the surveys seriously, as they will help me to provide more effective learning experience.

**Tentative Course Schedule:**

The tentative course schedule is published online at [http://mail.mcm.edu/~bykov.tikhon/phys4385/Physics4385/sec.html](http://mail.mcm.edu/~bykov.tikhon/phys4385/Physics4385/sec.html)