

CALIFORNIA STATE UNIVERSITY CHANNEL ISLANDS

NEW COURSE PROPOSAL

DATE SEPTEMBER 13, 2006

PROGRAM AREA PHYSICS

1. Catalog Description of the Course. *[Follow accepted catalog format.]*

Prefix PHYS Course# 406 Title SOLID STATE PHYSICS Units (3)

3 hours lecture per week

☒ Prerequisites PHYS 306

☐ Corequisites

Description Provides an introduction to the physical properties of solids, and their importance in high-tech applications. Focuses on the fundamental, unifying concepts and experimental techniques important in understanding the properties of nuclei and electrons in solids. Considers crystals defects that often control the actual properties of materials. The subjects are chosen to establish the basic principles, to describe phenomena that are responsible for the importance of solids in science and technology, and to include topics of current research.

☐ Gen Ed ☐ CR/NC ☐ Repeatable for up to _____ units

Categories

☐ Lab Fee Required

☒ A - Z

Total Completions Allowed

☐ Mission Based Learning Objectives: ☐ Interdisciplinary ☐ International ☐ Multicultural ☐ Service Learning

☐ Title V Section 40404: ☐ Government ☐ US Constitution ☐ US History

2. Mode of Instruction.

	Units	Hours per Unit	Benchmark Enrollment	Graded Component	CS # (filled in by Dean)
Lecture	3	1	24	<input checked="" type="checkbox"/>	_____
Seminar	_____	_____	_____	<input type="checkbox"/>	_____
Laboratory	_____	_____	_____	<input type="checkbox"/>	_____
Activity	_____	_____	_____	<input type="checkbox"/>	_____

3. Justification and Learning Objectives for the Course. (Indicate whether required or elective, and whether it meets University Writing, and/or Language requirements) *[Use as much space as necessary]*

This course as an upper division core requirement for the BS in Applied Physics, and an elective for the Math and Computer Science majors. A basic understanding of solid state physics is important for practicing physicists in all areas of study, and for many other related disciplines as well. The coupling of Solid State Physics and Quantum Physics is the basis for virtually all technological aspects of modern life.

Through this course, students will be able to

- describe solid materials in terms of their interatomic forces and bonds
- explain macro phenomena such as thermal conductivity, heat capacity and resistivity
- describe crystals in terms of lattice structures and dynamics
- explain the basic concepts of crystallography and the importance of periodicity
- explain the theory of semiconductors and provide common examples and their use
- describe the magnetic properties of materials
- demonstrate the role of solid state physics in other disciplines, and apply their understanding to these disciplines
- apply the basic concepts and principles of solid state physics to everyday applications
- understand the development of superconductivity from both experimental and theoretical viewpoints
- demonstrate the role of solid state physics in other disciplines, and apply their understanding to these disciplines

The course does not meet the University Writing and/or Language requirements.

4. Is this a General Education Course YES ☐ NO ☒

If Yes, indicate GE category and attach GE Criteria Form:

A (English Language, Communication, Critical Thinking)

A-1 Oral Communication	<input type="checkbox"/>
A-2 English Writing	<input type="checkbox"/>
A-3 Critical Thinking	<input type="checkbox"/>
B (Mathematics, Sciences & Technology)	
B-1 Physical Sciences	<input type="checkbox"/>
B-2 Life Sciences – Biology	<input type="checkbox"/>
B-3 Mathematics – Mathematics and Applications	<input type="checkbox"/>
B-4 Computers and Information Technology	<input type="checkbox"/>
C (Fine Arts, Literature, Languages & Cultures)	
C-1 Art	<input type="checkbox"/>
C-2 Literature Courses	<input type="checkbox"/>
C-3a Language	<input type="checkbox"/>
C-3b Multicultural	<input type="checkbox"/>
D (Social Perspectives)	<input type="checkbox"/>
E (Human Psychological and Physiological Perspectives)	<input type="checkbox"/>
UD Interdisciplinary	<input type="checkbox"/>

5. Course Content in Outline Form. *[Be as brief as possible, but use as much space as necessary]*

Solid State Physics provides the basis for the most important technological advances of the 20th century. It also provides a wide range of opportunities to observe the effects of Quantum Physics in action.

Specific topics include:

- A discussion of the basic concept of a lattice and some important and yet quite simple crystal structures;
- Theory of solids; interatomic forces; covalent, ionic and metallic bonds
- Macroscopic properties, thermal conductivity and resistivity
- Optical properties of solids
- Magnetic materials; Para, ferro, and diamagnetism
- The behaviour of atoms in a crystal; vibrational modes of a lattice and their quantization (“phonons”);
- The behaviour of electrons in a metal; “Free-Electron model” and the “Nearly Free-Electron model”; electron waves and lattice potential;
- Energy bands in crystals; Brillouin Zones;
- Semiconductors, direct and indirect band-gaps; the effects of doping a semiconductor; basic semiconductor devices such as the p-n junction;
- The phenomenon of superconductivity; key experiments; some attempts to explain superconductivity; the BCS (Bardeen-Cooper-Schreifer model).

Does this course overlap a course offered in your academic program? YES ☐ NO ☒

If YES, what course(s) and provide a justification of the overlap?

Does this course overlap a course offered in another academic area? YES ☐ NO ☒

If YES, what course(s) and provide a justification of the overlap?

Signature of Academic Chair of the other academic area is required on the consultation sheet below.

6. Cross-listed Courses (Please fill out separate form for each PREFIX)

List Cross-listed Courses

Signature of Academic Chair(s) of the other academic area(s) is required on the consultation sheet below

Department responsible for staffing: Physics

7. References. *[Provide 3 - 5 references on which this course is based and/or support it.]*

The Physics of Solids, Richard Turton (ISBN 0-19-850352-0)

Introduction to Solid State Physics, 7 th Ed., C. Kittel (ISBN 0-471-11181-3)

Solid State Physics, J. S. Blakemore, QC176.B63. 1985

Solid State Physics (2nd Ed.) (Wiley) by J.R. Hook & H.E. Hall

8. List Faculty Qualified to Teach This Course.

Dr. Geoffrey Dougherty
Dr. Gregory Wood

9. Frequency.

a. Projected semesters to be offered: Fall ☐ Spring ☒ Summer ☐

10. New Resources Required. YES ☐ NO ☒

If YES, list the resources needed and obtain signatures from the appropriate programs/units on the consultation sheet below.

a. Computer (data processing), audio visual, broadcasting needs, other equipment)

b. Library needs

c. Facility/space needs

11. Will this new course alter any degree, credential, certificate, or minor in your program? YES ☐ NO ☐

If, YES attach a program modification form for all programs affected.

Dr. Geoff Dougherty

Proposer of Course

10/31/2005

Date

Approvals

Program Chair

Date

Curriculum Committee Chair

Date

Dean

Date

California State University Channel Islands
New Course Proposal Consultation Sheet

1. Course Title: PHYS 406 Solid State Physics

2. Program Area: Math and Physics

Recommend Approval

Program Area/Unit	Program/Unit Chair	YES	NO (attach objections)	Date
Art				
Biology				
Business & Economics				
Education				
English				
History				
Liberal Studies				
Mathematics & CS				
Multiple Programs				
Psychology				
Library				
Information Technology				