CALIFORNIA STATE UNIVERSITY CHANNEL ISLANDS

NEW COURSE PROPOSAL

DATE: FEBRUARY 16, 2006
PROGRAM AREA MATHEMATICS AND PHYSICS

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

Prefix PHYS Course# 306 Title MODERN PHYSICS Units (3)
1.5 hours lecture twice per week
☒ Prerequisites PHYS 101 or PHYS 201, MATH 151
☐ Corequisites
Description Survey of modern physics. Topics include: Special relativity, the Bohr model, Quantum mechanics; photons, the photoelectric effect, probability density, matter waves, Schrodinger mechanics of simple systems, the Uncertainty Principle, tunneling, spin and angular momentum, atomic and molecular structure. Selected topics from nuclear and solid state physics. Applications of the principles will be emphasized.

	Graded	
☐ Gen Ed	☐ CR/NC	☐ Repeatable for up to units
Categories		
☐ Lab Fee Required	☒ A - Z	Total Completions Allowed

2. Mode of Instruction.

	Units	Hours per Unit	Benchmark Enrollment	Graded Component	CS # (filled in by Dean)
Lecture	3	1	16	☒	
Seminar				☐	
Laboratory				☐	
Activity				☐	

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 will become an elective for the Applied Physics Minor: and will be a requirement for the Applied Physics major, when it is implemented. It may also be taken by many Computer Science and Math majors.

Through this course, students will be able to

- explain the basic concepts and principles of relativity, gravity and quantum theory
- describe light as quantized particles and electromagnetic waves
- describe radioactivity and nuclear reactions
- describe quarks and elementary particles
- explain conservation and symmetry theories
- apply the basic concepts and principles of modern physics to everyday applications
- connect concepts and representations found in modern physics (such as graphs, diagrams, and equations) to objects in the real world
- apply problem-solving skills to practical problems in modern physics
- demonstrate the role of modern physics in other disciplines, and apply their understanding to these disciplines
- search and retrieve practical information
- use a variety of simulation programs, featuring data analysis and display, to derive conclusions about experimental situations
- organize and express ideas clearly and convincingly in oral and written forms.

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 ☐
A-2 English Writing ☐

A-3 Critical Thinking ☐
B (Mathematics, Sciences & Technology)
B-1 Physical Sciences ☐
B-2 Life Sciences – Biology ☐
B-3 Mathematics – Mathematics and Applications ☐
B-4 Computers and Information Technology ☐
C (Fine Arts, Literature, Languages & Cultures)
C-1 Art ☐
C-2 Literature Courses ☐
C-3a Language ☐
C-3b Multicultural ☐
D (Social Perspectives) ☐
E (Human Psychological and Physiological Perspectives) ☐
UD Interdisciplinary ☐

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

This course is a survey of modern physics. Classical physics is used to explain the every-day world in which we live. The theories of special and general relativity extend classical physics into the realm of the very fast - speeds approaching the speed of light. The theories of quantum mechanics extend classical physics into the realm of the very small - atomic dimensions and smaller. The story of modern physics includes the men and women who have performed the experiments and developed the theories. In this course, we will explore the relativity and quantum theories, their mathematical development, their experimental interdependence, and their historical context.

Relativity is essentially a new way of understanding kinematics, in the language of the time and space separation between two events. The principles of relativity will be applied to space travel. Quantization sets the stage for delving into the mysteries of the very small. The photoelectric effect will be related to the invention of the photomultiplier. Nuclear/Atomic physics discusses the "old" quantum theory of Bohr and its beautiful description of one-electron atoms. Wavelike Particles bring in an entirely unexpected way of thinking about our old friend the point mass: it can act like a wave under the right conditions!! Elements of the Schrodinger approach puts a particle into various kinds of "boxes". The goal is to understand the hydrogen atom. Statistical Physics gives the quantum way of thinking about large assembledges of interacting particles. We will conclude with a look at Solid State physics, which tells us about electrical and thermal characteristics of swarms of particles and the effect of periodic lattices on them.

Course Content:
Special relativity, time dilation, length contraction, energy-mass relationship
General relativity, gravity, and space warping
Quantum theory and its extrapolation to macroscopic environments
Nuclear atom and Bohr model
Radiation and spectra
Schroedinger equation, Heisenberg uncertainty, deBroglie wavelength
Electromagnetic waves interaction with matter
Photoelectric effect and Blackbody radiation
Nuclear structure and quantum levels
Angular momentum and particle spin
Bose and Fermi particles
Nuclear reactions and radioactivity
Lasers
Mossbauer effect
Elementary particles and quarks
Conservation and Symmetry theories

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.]*

Concepts of Modern Physics, Arthur Beiser McGraw-Hill; 6th edition ISBN: 0072448482
Modern Physics for Scientists and Engineers by Stephen Thornton and Andrew Rex. (Second Edition).
Modern Physics by R. Serway, C. Moses and C. Moyer.
Spacetime Physics, E. F. Taylor and J. A. Wheeler, W. H. Freeman; 2nd edition, 1992. ISBN: 0716723271
Modern Physics, 2nd edition, by Kenneth Krane (New York: Wiley, 1996).
Six Not-So-Easy Pieces, by Richard Feynman (New York: Addison-Wesley.

8. List Faculty Qualified to Teach This Course.

Dr. Geoff Dougherty

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

9/21/2005 — Date

Approvals

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Program Chair Date

_____

Curriculum Committee Chair Date

_____

Dean Date

California State University Channel Islands
New Course Proposal Consultation Sheet

1. Course Title: PHYS 306 Modern Physics

2. Program Area: Math/ 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				