CALIFORNIA STATE UNIVERSITY CHANNEL ISLANDS

NEW COURSE PROPOSAL

PROGRAM AREA

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

Prefix PHYS Course# 304 Title ELECTROMAGNETISM Units (4)
4 hours lecture per week
☐ Prerequisites PHYS 101 or 201, MATH 151
☐ Corequisites
Description A calculus-based introduction to the concepts and principles of electricity and magnetism. Topics include: electrostatics, magnetism, electromagnetic theory, fields, electromagnetic waves, Maxwell's equations, and the Special Theory of Relativity. A strong emphasis will be on analytical problem-solving skills and applications.

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

Through this course, students will be able to

- explain the basic concepts and principles of electrostatics and electrodynamics
- describe the connection between electricity, magnetism and electromagnetic waves
- describe examples and applications of electricity and magnetism in everyday life
- apply problem-solving skills to practical problems in modern technology
- demonstrate the role of electricity and magnetism 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.

Electromagnetic theory is illustrated with real-life applications in modern technology. Detailed examples are worked with step-by-step explanations to help students develop their problem-solving strategies and skills and consolidate their understanding. In addition to a meticulous development of traditional, analytical mathematical approaches, students are also introduced to a range of techniques required for solving problems using computers. The course provides a preparation for students who plan more advanced studies in electrodynamics as well as those moving into industry or engineering.

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]*

Vector analysis
Line and surface integrals
Electrostatics: charges, forces, fields, and potentials
Dielectrics and conductors: the interaction of materials with electrostatic charges.
Electric flux : calculations of flux for various geometries using direct integration and Gauss' Law.
Capacitance :calculating the electrostatic energy storage for parallel plates, cylinders, and spheres, with and without dielectric materials.
Magnetostatics : the source of magnetism and its connection with moving electrical charges.
Magnetic fields :determining the field for simple geometries using Biot-Savart Law and Ampere's law.
Magnetic :ferromagnetic, diamagnetic, and paramagnetic materials.
Electrodynamics :varying electric charge configurations and their associated fields.
Electromagnetic Induction :Lenz's law and the association between changing magnetic and electrostatic fields.
Self-inductance and mutual inductance :calculation of energy stored in magnetic fields.
Maxwell Equations :the relationship between electricity, magnetism and light.
The special theory of relativity.
Electromagnetic waves :the solution to Maxwell's equations and the connection to light.
Electromagnetic Radiation :properties of light.
Plasmas : properties.
Superconductors: the foundation of modern electronics.

In addition to the basic concepts, a variety of interesting applications and examples will be covered in this course, such as: lightning, pacemakers, electric shock treatment, electrocardiograms, metal detectors, magnetic levitation, bullet trains, electric motors, radios, TV, Aurora Borealis, rainbows, radio telescopes, and mass spectrometers.

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.]*

Foundations of Electromagnetic Theory. Reitz, J., Milford, F. and Christy, R., , 4th Ed, Addison-Wesley, 1993. (ISBN: 0-201-52624-7)
David J. Griffiths, Introduction to Electrodynamics (3rd Edition), Prentice Hall, 1999.
E.M. Purcell. Electricity and Magnetism. Berkeley Physics Course, Volume 2, Second Edition. McGraw-Hill ,1984. ISBN: 0070049084
Physics for Scientists and Engineers, 6th ed., Serway and Beichner. Harcourt.

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	2/22/2005
Proposer of Course	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 304 Electromagnetism

2. Program Area: Biology 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				