ROWAN UNIVERSITY CURRICULUM PROPOSAL

1902-350

PROPOSAL TITLE: Electricity + Magnetism I

CHECK APPROPRIATE: X UNDERGRADUATE ___ GRADUATE ___ SEMESTER HOURS 4

SPONSOR(S): E. Flores, + Dept Chem + Physics

DEPARTMENT/TELEPHONE # Chem + Phys -4555

CHECK ONE: X COURSE ___MINOR PROGRAM ___CONCENTRATION ___SPECIALIZATION

___ACHIEVEMENT CERTIFICATE ___CERTIFICATION PROGRAM ___MAJOR PROGRAM

Step #1 (Department)	Step #2 (Receipt)	Step #3 (School)
X Approved (Date) 9/12/97	SCC# 97-98-30	Reviewed Date: 10/20/97
___ Not Approved (Date)		___ Recommend to Approved
RJ Nealand (for)	10-9-97	___ Recommend NOT to Approve
Dept. Curriculum Chr.	Date Received Senate	Forward for Open Hearing:
9/12/97		X WITHOUT Reservations
Reviewed (Date)		___WITH Reservations:
RJ Nealand (for)		Comments: Pierce updated
Dept. Chr.	Senate Curriculum Chr.	KM-S
		School Committee Chr.

Step #4 (Academic Dean): ✓ Recommended ___ NOT Recommended ___ Conditionally Recommended (See Comments)

Comments:

Dean Signature/Date 10/27/97

Step #5 (Senate Curriculum Committee): Open Hearing Date: 11-19-97 Approved by Curriculum Committee Date 11-19-97

Returned to Sponsor(s) for the following reason:

Step # 6 (Senate) Date announced/voted on at Senate 11-25-97 If voted on: ___Approved ___NOT Approved

...e forwarded to Executive Vice President/Provost 12/1/97

Senate Curriculum Committee chair Signature/Date: 11/26/97

Step #7 (Executive Vice President/Provost): Date Received _____

___ Approved

___ NOT Approved If no, reasons are as follows:

Student Credit Hours 3

Faculty Load Hours 3

Equalized Credit Hours _____

Official Copy & Approval Sheet Filed (Date) _____

Executive Vice President/Provost Signature _____

Registrar

Date Approved Course Description Received 11/18/98

Hegis Taxonomy and Course Number Assigned _____

Date/Signature of Registrar Robert A. Kubat 11/25/98

Notification Forward:

✓ Senate Curriculum Committee Chairperson

✓ Department Chairpersons

✓ Academic Dean(s)

✓ Registrar

✓ Sponsor(s)

Transmittal 1/11/99

New Course

1. Details:

Title:	Electricity and Magnetism I
Sponsor:	Eduardo Flores and The Department of Chemistry and Physics
Credit Hours:	3
Course Level:	Undergraduate (Junior - Senior)
Curricular Effect:	Major Requirement
Prerequisites:	Physics II (1902.201), Mathematical Physics (1902.325), or permission of instructor
Implementation:	Fall 98
Resources:	Present faculty is adequate, facilities, and library holdings are available.

2. Rationale:

Electricity and Magnetism is a fundamental subject in physics. Even though this theory was completed by Maxwell when he proposed the famous Maxwell's equations about 150 years ago it is still extremely important today. Most scientists regard a solid knowledge of electricity and magnetism as essential for students choosing a career in physics because it is important to every specialized area of physics. . This subject provided the theoretical background for the discovery and development of much of today technology: radio, television, electric light, electric motors, lasers, communication at the speed of light, etc.

The required curriculum is remarkably uniform from program to program not only on a national level, but on an international level as well. Students begin their study with introductory courses in Mechanics, Heat, Waves and Optics, Electricity and Magnetism, and Quantum Mechanics. They then take more advanced courses in these same five areas to complete the "core" of their program.

Electricity and Magnetism I, II are supposed to replace our present 4 credit Electricity & Magnetism course. Electricity and Magnetism is an extensive subject that is difficult to cover in one semester. Our main concern is that students do not have enough time to digest so much material in one semester. We have come to the conclusion that Electricity and Magnetism should be a two semester course. Most institutions teach Electricity and Magnetism in two semesters. We believe that if Electricity and Magnetism is divided into two semesters our students learn and retain more from this important fundamental course.

We plan to cover the fundamental concepts in Electricity and Magnetism I and to deal with extensions and applications of the fundamental concepts in Electricity and Magnetism II. Thus, it is possible to conceive that Electricity and Magnetism I should be a requirement and Electricity and Magnetism II an elective of particular interest to those students planning to go to graduate school in a science.

Electricity and Magnetism can be naturally divided in two parts. The study of static fields and charges, electrostatics, can be the major topic of Electricity and Magnetism I. Electrostatics can help students become familiar with the mathematical tools needed to derive Maxwell's equations. Maxwell's equations are the fundamental equations of Electricity and Magnetism. Electricity and Magnetism II should cover some consequences of Maxwell's equations such as the generation and propagation of electromagnetic waves, scattering, special relativity etc.

3. Essence of the Course:

Objectives:
After completing this course the student will be able to:

1. Explain the connection between each of Maxwell's equations and corresponding physical facts
2. Derive Maxwell's equations in differential or integral form
3. Provide a conceptual explanation of electromagnetic waves
4. Be familiar with vector analysis applications to electrodynamics

Topics:

2. Electrostatics: electrostatic field, divergence and curl of electrostatic fields, electric potential, work and energy, conductors
1. Vector Analysis: vector algebra, differential calculus, integral calculus, curvilinear coordinates, Dirac delta function
3. Special Techniques for Calculating Potentials: Laplace equations, method of Images, separation of variables, multipole expansion
4. Electrostatic Fields in Matter: polarization, field of a polarized object, electric displacement, linear dielectrics
5. Magnetostatics: the Lorentz force, Biot-Savart law, divergence and curl of B, magnetic vector potential
6. Magnetostatic Fields in Matter: magnetization, field of a magnetized object, the H field, linear and non-linear media
7. Electricity and Magnetism: electromotive force, Faraday's law, Maxwell's equations

Possible Textbook:
David Griffiths, Introduction to Electrodynamics, second edition, 1989 (Prentice Hall, New Jersey)

Course Requirements:
Students are required to do weekly homework assignments, laboratory write ups, exams, and a final.

Evaluation:

1. Written Exams and Quizzes:
   Open book, closed book, "take-home"

2. Homework
   Weekly problem sets, papers, projects and other written reports
3. Class Participation
   Participation in class activities and/or class presentations
4. Course Evaluation:
   The departmental course evaluation form will be used at the end of the course

4. Consultation:
   Robert Newland, Department of Chemistry and Physics, Chair
   John L. Schmalzel, Electrical Engineering, Chair

5. Additional Information:
   none

6. Catalog Description

Prerequisites: Physics II (1902.201), Mathematical Physics (1902.325), or permission of instructor

This course utilizes vector calculus as applied to classic boundary value problems in electricity and magnetism. These problems include the study of the interaction of fields with matter. Maxwell's equations will be derived and several applications will be emphasized. Electromagnetic waves as applied to optics will be covered in detail.