

ROWAN COLLEGE  
CURRICULUM COMMITTEE

(R)

1902-370

PROPOSAL TITLE: New Course - Selected Topics in Advanced Physics

UNDERGRADUATE       GRADUATE       CREDIT HOURS

SPONSOR(S): Hong Ling

DEPARTMENT & TELEPHONE# Chemistry and Physics - 4855

CHECK ONE:  COURSE       MINOR PROGRAM       CONCENTRATION       SPECIALIZATION  
 ACHIEVEMENT CERTIFICATE       CERTIFICATION PROGRAM       MAJOR PROGRAM

<p style="text-align: center;">STEP #1 (DEPARTMENT)</p> <p>APPROVED/DATE: <u>10/11/96</u></p> <p>NOT APPROVED/DATE: _____</p> <p><i>[Signature]</i> DEPT. CURRICULUM CHR.</p> <hr/> <p>REVIEWED/DATE: <u>10/14/96</u></p> <p><i>[Signature]</i> DEPT. CHR.</p>	<p style="text-align: center;">STEP #2 (RECEIPT)</p> <p>SCC# <u>96-97-60</u></p> <p>DATE RECEIVED: <b>SENATE</b> <b>OCT 17</b></p> <p><b>RECEIVED</b></p> <p><i>[Signature]</i> SENATE/CURRICULUM CHR.</p>	<p style="text-align: center;">STEP #3 (SCHOOL)</p> <p>REVIEWED DATE: <u>10-7-96</u></p> <p><input type="checkbox"/> RECOMMEND TO APPROVE  <input type="checkbox"/> RECOMMEND NOT TO APPROVE</p> <p style="text-align: center;">FORWARD FOR OPEN HEARING</p> <p><input type="checkbox"/> WITHOUT RESERVATIONS  <input type="checkbox"/> WITH RESERVATIONS</p> <p>COMMENTS: _____</p> <p><i>[Signature]</i> SCHOOL COMMITTEE CHR.</p>
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<p>STEP #4 (ACADEMIC DEAN)</p> <p><input type="checkbox"/> RECOMMEND  <input type="checkbox"/> NOT RECOMMEND  <input type="checkbox"/> CONDITIONALLY RECOMMEND          (SEE COMMENTS)</p> <p>DATE &amp; SIGNATURE, DEAN OF SCHOOL: <u>12/11/96</u> <i>[Signature]</i></p>	<p>COMMENTS:</p> <p style="text-align: right;"><b>RECEIVED</b> DEC 6 3 1996</p>
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<p>STEP #5 (SENATE CURRICULUM COMMITTEE)</p> <p>DATE OF OPEN HEARING: <u>2-13-97</u></p> <p>APPROVED BY SENATE CURRICULUM COMMITTEE (DATE): <u>2/13/97</u></p> <p><input type="checkbox"/> RETURNED TO SPONSOR(S) FOR THE FOLLOWING REASONS:          _____          _____</p>	<p style="text-align: center;"><b>SENATE</b> <b>DEC 4</b> <b>RECEIVED</b></p>
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<p>DATE PRESENTED TO SENATE: <u>2-26-97</u></p> <p>NOTIFICATION TO EXECUTIVE VICE PRESIDENT/PROVOST (DATE): _____</p> <p>SENATE CURRICULUM COMMITTEE CHAIR SIGNATURE/DATE: <i>[Signature]</i> <u>4/6/97</u></p>	<p><input checked="" type="checkbox"/> APPROVED      <input type="checkbox"/> NOT APPROVED</p>
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STEP #7 (EXECUTIVE VICE PRESIDENT/PROVOST)

DATE RECEIVED \_\_\_\_\_

APPROVED: \_\_\_ YES \_\_\_ NO

IF NO, REASONS ARE AS FOLLOWS:

STUDENT CREDIT HOURS 4

FACULTY LOAD HOURS 5

EQUALIZED CREDIT HOURS \_\_\_\_\_

OFFICIAL COPY & APPROVAL SHEET FILED (DATE) \_\_\_\_\_

SIGNATURE, EXECUTIVE VICE PRESIDENT/PROVOST [Signature]

REGISTRAR

DATE APPROVED COURSE DESCRIPTION RECEIVED 28 Apr 97

HEGIS TAXONOMY AND COURSE NUMBER ASSIGNED 1902 370

DATE/SIGNATURE OF REGISTRAR [Signature]

NOTIFICATION FORWARD:

\_\_\_ SENATE CURRICULUM COMMITTEE CHAIRPERSON

\_\_\_ DEPARTMENT CHAIRPERSON(S)

\_\_\_ ACADEMIC DEAN(S)

\_\_\_ REGISTRAR

\_\_\_ SPONSOR(S)

## Selected Topics In Advanced Physics

<b>Course title:</b>	Selected topics in advanced physics
<b>Sponsors:</b>	Hong Y. Ling and faculty in physics (Jeff Hettinger, Jonathan Sagle, Karen Magee-Sauer, and Eduardo Flores)
<b>Credit Hours:</b>	4 s.h. (lecture & lab)
<b>Course Level:</b>	Junior or Senior
<b>Curricular Effect:</b>	Elective
<b>Prerequisites:</b>	Physics I, II, and III [1902.200 (or 1902.202), 1902.201 (or 1902.203), 1902.300]; Calculus II (1701.131); Mathematical Methods in Physics(1902.325)
<b>Time of Implementation:</b>	Fall 1997
<b>Adequacy of Resources:</b>	Present faculty and facilities are adequate. We will make efforts to enhance the library collection in physics, especially journal collection in physics.

### 2. Rational

Students in physics program begin their physics study with introductory courses in Mechanics, Heat, Waves and Optics, Electricity and Magnetism. Then, they take intermediate/advanced courses in these same areas to complete the "core" of their program. The core of the program is covered by advanced courses in Classical Mechanics, Electricity and Magnetism, Quantum Physics, and Optics. They can also take upper level electives to complement and expand on these basic areas. There are four physics electives in the current physics program. They are Statistical Mechanics, Mathematical Physics, Electric Circuits, and Independent Study.

Although the current program in physics meets the basic course requirement, it lacks the courses in many areas of physics that are important for students' career development as well as their involvement with faculty research. One of the fundamental roles of the upper-level physics elective is to expand student's understanding of physics. In our view, the four courses currently available do not serve that purpose very well. The new courses must be added to prepare our students in the areas of physics that make them more competitive and marketable.

The areas of physics that we want to introduce are Solid State Physics, Atomic and Molecular Physics, Computational Physics, Special Relativity, and Elementary Particles. It is not feasible to propose each of them as independent course because physics program is

traditionally small and we are limited by our faculty resources and student enrollment. We believe that the proposed course entitled Selected Topics In Advanced Physics (STAP) will partially, if not completely, solve this dilemma. It works as follows. One topic from the list of topics will be chosen each time the course is offered. A survey of our students' interest and faculty resources will be made before we decide the topic. Organized in this way, the STAP can achieve our objective of making advanced subjects in physics available to our majors with a limited number of faculty and students.

In summary, the topics covered in the STAP will prepare our students with broader background in physics, enable them to have more meaningful collaborative research experiences with faculty. Students will be more competitive whether being a graduate student or working as a research technician in industry or government laboratories.

### **3. Essence of the Course**

#### **(a) Objective**

After taking this course, students are expected to

- ◆ have a good conceptual grasp of the topic.
- ◆ developing analytical skills for solving physics problems that are mathematically challenging.
- ◆ develop experimental skills that are special to the experimental projects under the topic.
- ◆ have a good exposure of the literature related to the topic, and be familiar with the typical research subjects in the topic.
- ◆ be able to integrate their knowledge in the topic into the research projects and to produce more meaningful collaborative research experience with faculty.

#### **(b) Possible Topics**

##### **1. Solid State Physics**

It presents introductory Solid State Physics including crystal structure, crystallography, crystal binding, phonons, the free electron gas model, introductory band theory and the concept of a Fermi surface will be introduced. Basic instruments used in the solid state laboratory will be introduced. This course will facilitate the integration of general physics knowledge.

##### **2. Atomic and Molecular Physics**

This course will present the interactions responsible for the atomic structure. Atomic transitions and lifetimes and spectral lineshapes will be studied and observed using lasers. Popular spectroscopic techniques, such as Doppler-free and Raman spectroscopy will be

discussed and (possibly) demonstrated. Recent advances in the field, such as lasing without inversion, laser cooling, and Bose-Einstein condensates will be introduced.

### 3. Computational Physics

This course will present students with a variety of methods of numerical computing for differentiation, integration, ordinary differential equations, partial differential equations, and matrix. This course will emphasize how to apply these methods to solve and therefore to understand the problems in the advanced physics courses.

### 4. Special Relativity

In this course we will study the Lorentz transformations and their consequences. These transformations relate measurements of position and time made by two independent observers. A large number of physical phenomena such as time dilation, space contraction, that results from these simple transformations will be studied in detail.

### 5. Elementary Particles

This course deals with a study of the basic building blocks of matter and energy. How elementary particles combine to form other particles. The present model called the Standard model will be studied in detail. Some of the techniques used in detection of elementary particles will be discussed.

#### **(c) Evaluation Procedures:**

Students will be evaluated by homework, exams, class participation, and a final.

#### **(d) Course Evaluations:**

The departmental course evaluation form will be used at the end of the course.

#### **Consultation:**

(a) The faculty in Department of Chemistry and Physics have unanimously approved this course.

(b) Gary Itzkowitz, Chair, Department of Mathematics

(c) Don Stone, Chair, Department of Computer Science

### **Course Catalog**

Prerequisite: Physics I, II, and III [1902.200 (or 1902.202), 1902.201 (or 1902.203), 1902.563]; Calculus II (1701.131); Mathematical Methods in Physics(1902.325)

This course is aimed to expose students with advanced physics topics that are important for their career development and their involvement with faculty research. The topics includes, but not limited to, Solid State Physics, Atomic and Molecular Physics, Computational Physics, Special Relativity, and Elementary Particles. One topic from the above list will be chosen each time the course is offered.