

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 1902-572

DATE/SIGNATURE OF REGISTRAR 132 K. [Signature]

NOTIFICATION FORWARD:

___ SENATE CURRICULUM COMMITTEE CHAIRPERSON

___ DEPARTMENT CHAIRPERSON(S)

___ ACADEMIC DEAN(S)

___ REGISTRAR

___ SPONSOR(S)

Topics In Advanced Physics

Course title:	Topics in advanced physics
Sponsors:	Hong Y. Ling and faculty in physics (Jeff Hettinger, Jonathan Sagle, Karen Magee-Sauer, and Eduardo Flores)
Credit Hours:	4 s.h. (lecture & lab)
Course Level:	Graduate
Curricular Effect:	Elective
Prerequisites:	Physics I, II [1902.200 (or 1902.202), 1902.201 (or 1902.203)]; Atomic Physics (1902.563); Calculus II (1701.131); Mathematical Methods(1902.525)
Time of Implementation:	Fall 1997
Adequacy of Resources:	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. These are excellent topics for graduate physics study. However, 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 Topics In Advanced Physics (TAP) 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 TAP can achieve our objective of making advanced subjects in physics available to our graduate students with a limited number of faculty and students.

In summary, the topics covered in the TAP will prepare our graduate 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 high school teacher or working as a research scientist 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, a final, and a graduate laboratory project and/or research paper.

(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 [1902.200 (or 1902.202), 1902.201 (or 1902.203)]; Atomic Physics (1902.563); Calculus II (1701.131); Mathematical Methods(1902.525)

This course exposes students to the advanced physics topics that are important for their career development and their involvement with faculty research. The topics include, but are 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. The requirements of this course include a graduate laboratory project and/or research paper.