

(2)

ROWAN COLLEGE
CURRICULUM COMMITTEE

PROPOSAL TITLE: Applied Physics Laboratory 1902-530

UNDERGRADUATE GRADUATE CREDIT HOURS

SPONSOR(S): Jeff Hettinger

DEPARTMENT & TELEPHONE# Chemistry and Physics - 4855

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

<p>STEP #1 (DEPARTMENT)</p> <p><input checked="" type="checkbox"/> APPROVED/DATE: <u>12/14/96</u></p> <p><input type="checkbox"/> NOT APPROVED/DATE: _____</p> <p><u>[Signature]</u> DEPT. CURRICULUM CHR.</p> <p><input checked="" type="checkbox"/> REVIEWED/DATE: <u>10/16/96</u></p> <p><u>[Signature]</u> DEPT. CHR.</p>	<p>STEP #2 (RECEIPT)</p> <p>SCC# <u>964744</u></p> <p>DATE RECEIVED: SENATE</p> <p style="text-align: center;">OCT 17</p> <p style="text-align: center;">RECEIVED</p> <p><u>[Signature]</u> SENATE CURRICULUM CHR.</p>	<p>STEP #3 (SCHOOL)</p> <p>REVIEWED DATE: <u>11-7-96</u></p> <p><input checked="" type="checkbox"/> RECOMMEND TO APPROVE</p> <p><input type="checkbox"/> RECOMMEND NOT TO APPROVE</p> <p style="text-align: center;">FORWARD FOR OPEN HEARING</p> <p><input type="checkbox"/> WITHOUT RESERVATIONS</p> <p><input type="checkbox"/> WITH RESERVATIONS</p> <p>COMMENTS: _____</p> <p><u>[Signature]</u> SCHOOL COMMITTEE CHR.</p>
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<p>STEP #4 (ACADEMIC DEAN)</p> <p><input checked="" type="checkbox"/> RECOMMEND</p> <p><input type="checkbox"/> NOT RECOMMEND</p> <p><input type="checkbox"/> CONDITIONALLY RECOMMEND (SEE COMMENTS)</p> <p>DATE & SIGNATURE, DEAN OF SCHOOL: _____</p>	<p>COMMENTS:</p> <p style="text-align: right;"> </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) _____</p> <p><input type="checkbox"/> RETURNED TO SPONSOR(S) FOR THE FOLLOWING REASONS:</p> <p>_____</p> <p>_____</p>	<p style="text-align: center;">SENATE</p> <p style="text-align: center;">DEC 4</p>
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<p>STEP #6 (SENATE)</p> <p>DATE PRESENTED TO SENATE <u>2-26-97</u></p> <p><input checked="" type="checkbox"/> APPROVED <input type="checkbox"/> NOT APPROVED</p> <p>NOTIFICATION TO EXECUTIVE VICE PRESIDENT/PROVOST (DATE) _____</p> <p>SENATE CURRICULUM COMMITTEE CHAIR SIGNATURE/DATE: <u>[Signature]</u> <u>4/9/97</u></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 20 Apr. 97

HEGIS TAXONOMY AND COURSE NUMBER ASSIGNED 1902-530

DATE/SIGNATURE OF REGISTRAR [Signature]

NOTIFICATION FORWARD:

___ SENATE CURRICULUM COMMITTEE CHAIRPERSON

___ DEPARTMENT CHAIRPERSON(S)

___ ACADEMIC DEAN(S)

___ REGISTRAR

___ SPONSOR(S)

**Applied Physics Laboratory
New Physics Course for Graduate Students**

1. (a) Course Title: Applied Physics Laboratory
(b) Sponsors: Jeff Hettinger and Physics Section, Dept. of Chemistry and Physics
(c) Credit Hours: 4 s.h. (2-three hour sessions; lecture and laboratory)
(d) Course Level: Graduate
(e) Curricular Effect: none
(f) Prerequisites: Physics III
(g) Implementation: Fall 1997; offered every other year (e.g. F97, F99, F01,...)
(h) Adequacy of resources: Present staffing is adequate and experimental equipment exists to launch the course (upgrades recommended)
(i) Recommended Library Resources: Experimental techniques are established and available in existing library holdings. Techniques which do not appear in books will be copied from journals which are held by our faculty.

2. Rationale:

Learning through direct experience is undeniably an effective mechanism leading to a detailed understanding of any topic. Advanced topics in the sciences are particularly difficult to process into knowledge and by far the most effective means of learning these is through direct experience. Laboratories partially provide the experience needed to grasp these advanced topics.

An advanced experimental course is essential to any physics curriculum. It requires students to integrate knowledge from several areas and apply it to a specialized area of physics including Atomic, Condensed Matter, Nuclear and Astrophysics. Students successfully completing this course will improve their performance in collaborative research with faculty while continuing to solidify their physics background.

Students taking graduate courses from our department generally are not pursuing a graduate degree in physics. They are trying to develop skills which they can apply immediately, enhance their knowledge base to improve their position with regard to their present employer, or take a course which will help them become better teachers at the high school level. Each of these objectives are served in this course. In addition, students who would like to enhance their possibility of working in research groups will develop a better understanding of general experimental techniques and instrumentation. The analysis of the experiments will develop students analytical skills making themselves much more marketable regardless of their career path.

3. Essence of the Course:

A. Objectives

Graduate Objectives:

Students will perform an independent project employing one or more of the experimental techniques developed in class to enhance their ability to analytically solve an experimental topic of interest. Performance on this independent experiment/project will be evaluated based on complexity, success, and communication of results in the form of a paper.

Overall Objective:

After taking this course, students with the appropriate equipment will be able to make a reliable measurements of materials properties in a variable

temperature environment, be able to understand and use spectroscopic techniques used in atomic and astro-physics, and be able to measure levels of radioactivity as would be appropriate for a Health Physics Technician.

Individual Objectives:

1. The students will reinforce their knowledge of advanced physics through the measurement of physical quantities in the laboratory providing experiences which transform classroom concepts into reality.
2. The students will develop analytical skills through analysis of measurements.
3. The students will understand the use and operation of several laboratory instruments and develop some experimental intuition which will eventually help them design simple experiments.
4. Students will develop experimental skills which will make collaborative research experiences with faculty more meaningful.
5. Students will learn how to keep a laboratory notebook (sounds trivial but this is difficult and essential).
6. Students will begin developing writing skills appropriate for technical presentations.

B. Topical Outline:

Students will be required to perform from four to six experiments through the semester. Each one requires a paper be written with the following constituents: (a) Introduction (including relevance of the experiment and background); (b) Theory of the experiment; (c) brief procedure; (d) data including plots and tabulated analysis and associated errors; and (e) summary. Oral presentation of results of one of the experiments will be performed by each student during the semester. This will be a presentation in the format of a contributed paper at national meetings such as those sponsored by the American Physical Society or the Materials Research Society. In addition, students will use one of the techniques to measure something of interest to the student. Choice will be made through consultation with the faculty member instructing the course

Possible experiments

- *1. AC screening response of a material with very small resistivity.

We have the equipment to perform this measurement at an introductory level. By creating an environment where a magnetic field can be applied at low temperatures, this could be improved. Demonstrates the penetration depth and frequency dependence of the penetration depth of a time varying magnetic field.

- *2. Four probe resistance measurement.

We have the equipment to perform this measurement. This technique must be employed to measure very small resistances. Determination of the scattering lengths in various conductors will be made. Measurements of V-I curves for materials with linear response (metals) and non-linear responses

(semi conductors) will be made.

***3. Two probe conductivity measurement.**

Materials with non-ohmic voltage-current characteristics will be measured using existing electrometers and a constant voltage source. These techniques are important for determining charge transport process in non-crystalline materials.

4. DC magnetization measurements

This experiment will employ Faraday techniques to measure the force on a specimen using a capacitance transducer. The capacitance will be measured using a Tunnel-Diode-Oscillator circuit. The resonance frequency of this circuit is extremely sensitive to small changes in capacitance allowing a very reliable measurements of very small changes in magnetization.

***5. Thermal Activation over an energy barrier(demonstration of the Grand Canonical Distribution in Statistical Mechanics)**

This can be performed with existing equipment.

6. Tunneling- Typical planar tunneling devices will be measured and tunneling phenomena introduced. The exponential distance dependence of the tunneling probability will be demonstrated.

***7. Doppler broadening of atomic transitions will be measured using techniques of atomic physics. This will be applied to find the statistical distribution of velocities of the molecules in the gas.**

***8. Nuclear physics- Mossbauer experiment, decay rates and shielding of various radioactive materials.**

***9. Spectroscopic techniques will be introduced through the measurement of the Zeeman splitting in sodium. The subsequent analysis will be applied to spectra measured on interesting Astrophysical entities.**

***10. Measurement of lifetimes of excited states in alkali atomic vapors.**

*Experiments which can be performed Fall 97.

+general - Actual laboratories will be modified to reflect changes in available equipment.

C. Evaluation Procedures for Students

Evaluation will be based on written work (including laboratory notebook), experimental skills (knowledge of instrument operation) and the oral presentation. Emphasis in written work will be placed on quality compared to professional presentations. Performance on independent experiment will be evaluated based on complexity, success, and communication of results in the form of a paper.

D. Course Evaluation

The department evaluation form will be used at the end of the course. A less formal continuous feedback will be solicited from students throughout the semester.

4. Results of Consultations

The faculty of the Chemistry section of the Chemistry and Physics department approved this course.

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5. Catalog Description:

Prerequisites: Physics III

This course introduces modern experimental techniques commonly used in physics. Experimental results will be correlated with existing theories. Technical writing skills will be developed and evaluated.