# SYRACUSE UNIVERSITY

# COLLEGE OF ARTS & SCIENCES

# DEPARTMENT OF PHYSICS

# Departmental Policy and Governance Documents

## Table of Cont ents

# I. DEPARTMENT OF PHYSICS BYLAWS

## 1) Faculty Meetings

### *1.a) Those eligible to attend*

All currently employed professorial faculty with full-time or part-time non-adjunct appointments in the Physics Department, as well as visiting and retired faculty, are eligible to attend. Students and other individuals may be invited to attend by the Department Chair. The Department Chair is encouraged to invite students annually to discuss issues pertinent to the Department as a whole.

### *1.b) Those eligible to vote*

All currently employed tenured or tenure track faculty, including those on leave, are eligible to vote. Teaching professors with contracts of at least three years in duration are eligible to vote on all matters except for promotion and tenure and hiring of tenure-track or tenured faculty.

This includes any individual with a joint appointment providing the Physics Department pays some portion of his or her salary.

### *1.c) Quorum*

50% of those eligible to vote, not counting those on leave, must be present in order for any votes taken to be counted as valid expressions of faculty will.

### *1.d) Scheduling of Meetings*

Normally, meetings will be called at times determined by the Department Chair. A meeting may also be scheduled upon petition signed by one-third of the members of the Department who are eligible to vote. In order that actions taken at any meeting be considered valid, written or electronic notice of the meeting time and place must be given to all faculty eligible to vote, at least two days prior to the meeting.

### *1.e) Voting*

Votes will be taken by show of hands, except that votes on whether to recommend hiring, promoting, or granting tenure to specific faculty candidates, and to recommend a candidate to serve as Department Chair will be by secret ballot. Upon request from any member eligible to vote, any pending vote will be taken by secret ballot.

A motion may be made to authorize the Department Secretary to conduct a delayed vote by e-mail on a motion presented at a meeting. Such motions must specify a timetable for collecting the vote. The exception to this is votes for hiring, promoting, or granting tenure to specific faculty candidates, which must be conducted as described in 1.e) (ii) and (iii) below.

The Department Chair will designate a member of the department's office staff to collect secret ballots. The results of secret ballots will be collated and typed into a single document by the staff member and presented to the Department Secretary with the identity of the voting faculty members removed after the voting period is closed.

All issues will be settled by majority vote of those present and voting except in the following cases:

(i) Amendments to the bylaws require an affirmative vote of 2/3 of those present and voting.

(ii) Affirmative recommendations on tenure and promotion require a positive vote by a 2/3 majority those voting. For such motions vote will be postponed to the next faculty meeting after adjournment of the faculty meeting during which the motion is initially presented. Votes and comments must be submitted via paper or email within 48 hours of the motion being called for a vote.

(iii) Affirmative recommendations on appointing a new, tenure-track faculty member require a positive vote by a 2/3 majority of those voting. For such motions, the motion may be put to a vote in the faculty meeting during which the motion is presented, unless the motion deviates from the authorized parameters of the search. Votes may be submitted by paper or email up to 24 hours after the motion is put to a vote. In cases where the motion presented deviates from the previously authorized parameters of the search, then the motion must be postponed to a subsequent faculty meeting. Votes may be submitted via paper or email within 24 hours of the motion being put to a vote.

In case of any delayed vote where the final tally is unavailable at the faculty meeting, the Department Secretary will inform the faculty of the outcome as soon as possible after the final tally is known.

#### *1.f) Conduct of Meetings and Parliamentary Procedures*

The Department Chair or someone s/he designates will chair all meetings called by the Department Chair. In the case of a meeting called by petition, those attending who are eligible to vote may elect any one of their members to chair that meeting. Meetings will be conducted according to Robert's Rules of Order.

### 2) The Department Secretary

#### *2.a) Election and Term of Office*

The secretary will be elected by the Faculty during the spring semester and will serve for a term of one year.

#### *2.b) Duties*

The duties of the secretary will be to record minutes and conduct votes as defined in other articles of the bylaws.

*(These bylaws were adopted at the Department faculty meeting on April 29, 1998; voting priveleges for long-term teaching professors added Jan. 18, 2017; changes to Department Secretary and to voting on Promotion and Tenure and on modified searches approved April 26, 2017).*

# II. PROCEDURES FOR NEW FACULTY APPOINTMENTS

## Tenured and Tenure-track Faculty Appointments

*Procedures as edited by M. Goldberg, ca. 1995.*

1. The chairperson appoints a search committee of faculty members with the approval of the faculty. This committee handles Affirmative Action procedures and publicity for the position. It processes all applications (as necessary in consultation with other faculty members) and invites leading candidates for colloquia or seminars addressed to the whole department.
2. A meeting of the regular faculty is called by the chairperson who puts discussion and voting on new faculty on the agenda of that meeting. In advance of the meeting, the search committee provides the faculty with all necessary information about each candidate. Objections to a candidate can be raised with the search committee prior to the meeting. ~~A quorum at the meeting consists of 2/3 of the regular faculty.~~ *Superseded by Department Bylaws adopted April 1998.*
3. At the meeting, prior to the discussion, the search committee makes a presentation of its recommendations, providing evidence for their ranking of the candidates and indicating their strengths and weaknesses. The discussion must also include consideration of the needs of the various research groups.
4. ~~The recommendations of the faculty are carried by a majority vote.~~ *Superseded by Department Bylaws adopted April, 1998.*

## Non-tenure-track Faculty Appointments

*Procedures as edited by E. A. Schiff, February 2000.*

*From the Faculty Manual (Edition 18)*

The appointment from the dean or department chairperson is the contractual agreement between the University and the appointee. All faculty appointments shall be in writing. To be binding, such agreement must be authorized by the Chancellor or the Vice Chancellor for Academic Affairs. At the time of appointment, faculty members should clearly understand appointment terms, conditions, and benefits, including rank, salary, tenure status, term of employment, retirement benefits, group life insurance, and health insurance.

*Department Procedures*

The Department Chair may make non-tenure-track faculty appointments; these appointments generally substitute for tenured or tenure-track faculty members on leave. Whenever possible, appointments with faculty rank (assistant professor or higher) should follow the same procedures as those used for appointment of tenured or tenure-track faculty, including passage of a resolution endorsing the appointment at a faculty meeting. Appointments as instructor are done without faculty approval.

## Research Faculty Appointments

*From the Faculty Manual (Edition 18)* Note that this has been supercded

Research faculty members are those whose appointment complements the research program of a department, school, or college. These appointments are not to replace regular faculty positions, nor should they be seen as creating long-term of career positions. Rather, they are intended to enable the University to bolster its research program at very limited cost by formally appointing strong scholars who are supported exclusively by extramural grants.

Individuals may be appointed research faculty members at the rank of assistant, associate, or full professor. Reappointment and promotion criteria are similar to the research criteria for regular faculty members at the same rank.

Research faculty members are eligible for benefits, library privileges, parking permits, bookstore discounts, and use of recreational facilities on thes same basis as regular faculty members.

The position of Research (Assistant/Associate) Professor is not a tenure-track position. time spent in this position does not accrue toward tenure, and it is not normally possible to move fro this position into a tenure-track position at Syracuse University.

### *Departmental Procedures*

*These procedures were edited by M. Goldberg, ca. 1995.*

Opportunities arise in a number of fields to appoint individuals to research faculty positions as a means of complementing the research program of a department, school or college. These appointments enrich the research environment of the unit by bringing in colleagues with valuable technical skills, complementary research techniques, or diverse perspectives. These appointments are not to replace regular faculty positions, nor should they be seen as creating long–term career positions. Rather, they are intended to enable the University to bolster its research program at very limited cost by formally appointing strong scholars who are supported exclusively by extramural grants. The number of these positions will be limited so as not to distort the faculty profile and research activities of the unit and may be made only when the necessary laboratory and office space is available.

The following guidelines govern the appointment of research faculty at Syracuse University.

To be eligible for appointments as a research faculty member, the individual will normally have developed an externally funded research program that complements the work of others in the unit. In some instances, a department, school or college may seek a research appointment without salary or benefits for an individual who has not established an independently funded research program but who is judged to have the potential to obtain in the near future external funding as a principal investigator. Research proposals written by such an individual must be endorsed by a regular faculty member in the appropriate field.

In all cases, there will be no university-provided salary, fringe benefits or operating fund support for a research faculty member: externally–derived funds must be the source of all support.

The appointment is initiated by full departmental consideration, with a formal recommendation to the dean. The evaluation process should conform as far as practical with the regular departmental hiring procedures.

The appointment is made with the concurrence of the dean of the school or college, the Vice President for Research, and the Vice Chancellor for Academic Affairs. The appointment is contingent upon the satisfaction of eligibility requirements for employment as specified in the Immigration Reform and control Act of 1986.

Individuals may be appointed research faculty members at the rank of Assistant, Associate, or full Professor. Performance must be reviewed annually. Reappointment and promotion criteria are similar to the research criteria for regular faculty members at the same rank.

Research faculty will have consulting privileges, subject to review through the usual mechanisms for faculty. They will be eligible for independent principal investigator status on research grants (this is the fundamental difference between research faculty appointments and other research or visiting appointments) and may act as the supervisor of record for postdoctoral research associates and technical personnel employed by research grants of which they are principal investigator. They may not serve as the research preceptor of record for undergraduate or graduate students, but may participate in research

supervision of students in cooperation with a regular faculty member of the university. They will have no teaching duties or responsibilities of service to the University, although they may volunteer to lecture on topics of interest to them.

Research faculty members are eligible for benefits, library privileges, parking permits, bookstore discounts, and use of recreational facilities on the same basis as regular faculty members.

The position of Research (Assistant/Associate) Professor is not a tenure–track position. Time spent in this position does not accrue toward tenure, and it is not normally possible to move from this position into a tenure–track position at Syracuse University.

The appointment letter should be written in conformity with the model contained in the Guidelines on Appointment Letters.

Departmental office and laboratory space may be made available to the individual at the discretion of the department chairperson, with the concurrence of the Associate Vice Chancellor for Academic Affairs.

Limited–term research faculty appointments (3 years or less) are normally granted by the department upon presentation of the candidate's credentials. Long–term research faculty appointments are normally treated in the same manner as untenured faculty appointments.

*(~~Research professors will be voting members of the department faculty, except in matters relating to faculty hiring, tenure and promotion~~. S*uperseded by the Department bylaws adopted in April, 1998).

Research professors will have offices and access to the staff and facilities of the department, equal to those of regular faculty.

### Reappointment

*(A policy governing reappointment of research professors should be developed.)*

### Resigning Faculty

As of the effective date of resignation, faculty may apply for the position of Research Professor of Physics. This will be a fixed term, renewable appointment. The appointment will not require participation in a research grant, but will require an active research program.

## Adjunct Faculty Appointments

*From the Faculty Manual (Edition 18)*

Adjunct faculty appointments may be offered to individuals who hold regular employment elsewhere and with whom the University has a special collegial relationship. They are eligible for occasional teaching assignments on an as-needed basis. Adjunct faculty members are not eligible for University benefits, but they may obtain an identification card entitling them to use the library and athletic facilities, and to receive a discount on bookstore purchases.

### *Department Procedures*

*Procedures as edited by E. A. Schiff, September, 2002.*

An offer of an adjunct faculty appointment may be initiated by the Department chair, and is made with the concurrence of the Dean of the College. Adjunct faculty positions are courtesy appointments that are offered to encourage participation in the Department's and the University's affairs. Adjunct faculty will be included in the Department Directory and in faculty mailing lists; they may not attend faculty meetings except by special invitation by the chair.

## III. PROCEDURES FOR PROMOTION AND TENURE RECOMMENDATIONS

Departmental procedures and standards are subordinate to the procedures and standards of the College of Arts & Sciences. The Department faculty report to the College's promotion and tenure committee, which awards promotions and which makes recommendations to the Dean regarding tenure.

The following standards and procedures were adopted by vote of the Department promotion and tenure committee on (date unknown).

### 1. Standards For Tenure

A record of sustained success in teaching, or creative intellectual work related to teaching, is an absolute requirement for tenure. The tenure candidate should have taught in a variety of course situations. Documentation of teaching sources should be provided. Lack of substantial service record shall not normally prevent a candidate from receiving tenure, but a below-average service record should be redressed by unusually strong teaching and scholarship.

The scholarship must be sufficient for the candidate to have achieved a national reputation among a group of scholars in the defined area of specialization. The candidate must already have demonstrated scholarly accomplishment—and clear promise of continued high-quality scholarly productivity—through published work and papers presented at professional conferences. In all fields, the candidate's published dissertation, without major revision and the addition of important new materials, should not be advanced as a principal item in the publication record. Candidates are also judged for their success in obtaining funding for research proposals and in guiding doctoral candidates to completion of their degree programs to appropriate placement in the professions.

The awarding of tenure is, in part, a future-oriented decision. Thus, the candidate's promise, as judged by past performance and the value and coherence of future research plans, is an important consideration, as is the degree to which the projected contributions of the candidate match the future needs of the department.

In the field of physics, collaboration with one or many individuals is common. This is not the case for tenure and promotion candidates in other fields. Therefore, a detailed explanation of the candidate's participation in collaborations may be necessary for the college committee. Multiple authorship is also common in physics, and the committee should therefore describe the contributions of the author when appropriate. The journals available to the candidate for publications in comparison with the actual choice of journal also needs thorough discussion.

### 2. Standards For Promotion To Associate Professor

The standards for promotion to Associate Professor, in regard to past performance in the areas of teaching, service and scholarship, should be the same as those for tenure. No person should receive tenure who would not also qualify for promotion to Associate Professor.

### 3. Standards For Promotion To Professor

A sustained commitment and a successful record of teaching and academic service should be demonstrated for all candidates. In addition, an international reputation based on seminal scholarship should be an essential criterion for promotion to professor. This degree of impact should be documented by written evaluations from the leaders in the candidate's field. Other evidence of scholarly impact, such as frequency of citation of the candidate's scholarly publications, invitations to present seminars and major addresses, success in obtaining research funding, and the receipt of awards, prizes, editorships, and other forms of professional recognition are particularly important as evidence of professional stature

sufficient to merit promotion to professor. The total body of scholarship should place the candidate among the mature leaders of the discipline.

## 4. Procedures for Continuing Appointment and Reappointment of Tenure-track Professors

Procedures ratified by faculty on March 8, 2002, modified by faculty motions on Dec. 8, 2004 and

*General Procedures*

1. For each candidate, an evaluation committee is to be formed, consisting of three faculty members. Two of the faculty members are appointed by the departmental chairperson, one may be chosen by the candidate. If no choice is made by the candidate, the third faculty member will be appointed by the chairperson also.
2. The faculty voted on 12/8/04 that graduate students no longer serve on committees for promotion, tenure, and non-tenured faculty reviews. ~~An undergraduate and graduate student representative shall make a presentation on teaching and advising to the entire promotion and tenure committee~~ (removed by Faculty vote Sept. 25, 2015). The P&T subcommittee for a candidate shall select the students, and consult with them during the preparation of a case.
3. This committee will perform the duties of evaluation for the yearly continuing appointments, as well as the reappointment at the end of the first three year period. The same committee will normally continue these duties until no further promotion or tenure deliberations.
4. The committee will make a written report and recommendation regarding the candidate's continuing appointment or reappointment. In case of divergent opinions, there should be a majority and minority report.
5. The report will be presented to a meeting of the Department's promotion and tenure committee (see following section) for revision and approval.
6. Any letters received in support of the candidate's reappointment will be considered confidential, unless the candidate refuses to waive his/her right of access to these letters.
7. The candidate has the right to examine the report. In case of a detrimental report, he/she may request a meeting with the department before the report is forwarded to the Dean.

*Guidelines For Committees For Annual Evaluation of Nontenured Faculty*

Collect from the candidate the following information:

- List of publications (with reprints and preprints).
- List of papers presented at meetings.
- List of present advisees and degrees granted under candidate's supervision.
- Seminars and colloquia given.
- Conferences attended.
- Committee work, service to department, college or university.
- Description of research–in–progress and goals, including acquisition or construction of laboratory equipment, grants and other support, and collaborations.
- Candidate's comments on his teaching experiences at SU.

Other information to be gathered by Committee:

*On candidate's teaching and advising*

- Student comments received by department chairperson and surveys for all courses taught;
- By announcement seek comments from students, graduate and undergraduate advisees (these comments may be conveyed either orally at a hearing with the committee, or in writing); and
- Course syllabi and a list of courses taught by the candidate is to be compiled and made part of the committee's report.
- Solicit comments from members of the faculty or department. The committee may request some comments in writing.
- Opinions from outside the department are not required, but may be sought by the candidate or the department.

*Peer Review of Teaching*

The College of Arts & Sciences requires peer review of teaching as a component of all promotion and tenure cases. In the appendices, there is a memorandum written by the Department Chair that should be given to each assistant or associate professor each semester that informs them about this requirement and that suggests how to satisfy it; these procedures and memoranda have not been specifically considered by the Department faculty.

## 5. Procedures For Physics Department Recommendations For Promotions And Tenure

*Adopted by vote of the Departmental Promotions and Tenure Committee on 6-October-2000.*

The following rules concern the procedures but not the substance of the departmental promotions and tenure review process. No attempt was made here to define the department's criteria for promotion or tenure, pertaining to the categories of research, teaching and service, nor to define the contents and format of the report to be prepared.

It is assumed that format and content will be prescribed in future Arts and Sciences guidelines. The criteria should be the department's, and should perhaps be formulated explicitly by a committee in the future.

- The voting members of the Department Promotion and Tenure Committee will consist of the tenured faculty. Those eligible to vote will have rank equal to or above the rank sought by the candidate (motion adopted on 1-October-2014 faulty meeting). Affirmative recommendation on tenure and promotion require a positive vote by a 2/3 majority of those voting. (motion adopted on 15-September-2010 faculty meeting; also in faculty bylaws). The vote on a promotion and tenure decision will be held in a faculty meeting subsequent to the presentation of the promotion and tenure case to the faculty (faculty bylaws as amended April 26, 2017).
- The task of assembling all necessary information is to be carried out by an Evaluation Committee consisting of three faculty members. This committee is appointed by the Department Chairperson. The candidate may select one of the faculty members on the committee.
- The Evaluation Committee will present its findings in a written report to be available to all members of the Promotions and Tenure Committee but not to the candidate.
- The full Promotions and Tenure Committee will meet to discuss the report in light of the department's criteria for promotion and tenure.
- The Promotions and Tenure Committee will vote by secret ballot on the recommendation to the College Committee to grant tenure and/or promotion. *Note: The Department bylaws specifically*

*allow for a 48 hour period for delayed voting of those not present at the promotion and tenure committee meeting.*

- The candidate will be informed of the outcome of the vote.
- In case of an unfavorable vote, the candidate may request a meeting with the Promotions and Tenure Committee.
- In any case, the candidate has the right to withdraw his request for promotion or tenure before the report goes to the College Committee.

### *Information Concerning Teaching*

This information is most likely added by the Department chair.

Please be sure to include in the promotion and tenure packet (for each course taught by the candidate):

- course syllabus
- course surveys
- peer reviews

### *Procedure for Obtaining External Reviews*

#### Number of Reviews Sought

At present, six external reviews are required by the Vice-Chancellor for tenure. The department committee should seek substantially more than this to ensure the timely receipt of at least seven. Requests to reviewers should be mailed before the end of the spring semester. The recommended number is at least seven. The receipt of reviews should be carefully monitored, so that backup requests can be issued when necessary. All reviews received should be forwarded to the college committee.

#### Source of Reviewers

The committee is encouraged to solicit reviewer recommendations from the following sources:

- Department faculty with research in related areas
- Faculty—other physics departments or laboratories
- Collaborators of the candidate
- The candidate

The department committee should compile a list with help from the first three sources listed. Then the candidate should be shown the list and invited to add more names. The candidate may wish to submit written comments concerning the appropriateness of any of the individuals on the list compiled by the committee—especially in case the candidate would prefer that anyone be excluded; such a request, however, if acted upon, would be included as part of the dossier transmitted to the college committee. The vice-chancellor for academic affairs has requested (Spring 2000) that reviewers for tenure cases should not in general be persons close to the candidate (co-authors, friends from graduate school, etc.), that they should generally be full professors (or persons of comparable rank from outside the academy), and that they should be from institutions considered better than Syracuse; all exceptions should be justified. The Department of Physics acknowledges that exceptions to this request may often be required to fully review a candidate. A letter from the candidate's dissertation advisor may be included if the Department believes such a letter will be useful (if so, justify).

At least four of the reviews received should be from the list suggested by the committee. The basis for selecting each reviewer should be documented, together with a brief biography of the reviewer.

### Content of Reviews

The reviewers should assess the past accomplishments and future potential of the candidate. Comparisons with other individuals in the field should be strongly encouraged. A sample letter to reviewers is attached. A full C.V., along with lists of publications and presentations, should be transmitted with the letter. If certain reviewers are also collaborators of the candidate, the rationale for this choice should be explicitly stated.

The review should examine the published journals of the candidates, and provide the committee with information about the journal in terms of its prestige and function.

*Sample of letter to promotion and tenure referees*

(updated May, 2015)

**DATE**

_____

Dear Professor _____:

During the 2015-16 academic year, Professor ____ _____ will be considered for promotion to the rank of **[Tenured Associate Professor/Full Professor]** at Syracuse University.

On behalf of our departmental evaluation committee, I would like to ask for your assistance in evaluating Professor _____. This would entail reviewing **his/her** record and writing a letter of evaluation. Your signed letter (on letterhead, please) will be most useful if received by August 1, 20___ (an electronic version is sufficient). We would need your evaluation of the originality, quality and rate of Professor _____'s scholarly work and the impact of **his/her** scholarly efforts in **his/her** field. Any comments that you might be able to provide on **his/her** abilities and success in teaching and service are welcome too. I also ask you to indicate whether you would support the case for promotion if the case were pending in your own department, and why or why not. Comparisons of Professor _____ with other individual faculty with comparable credentials are particularly useful.

The College committee that will review Professor ____ is particularly concerned with work done since **he/she** was [**hired at Syracuse University at the rank of Assistant Professor in August, ____/ promoted to the rank of Associate Professor in August, ___]**. The candidate's CV and publications can be found at the links under my signature. Where appropriate, we would appreciate specific references to the publications of the candidate. Since the majority of members of the College committee will have no scientific background, it would be helpful if you will include some general evaluation that will be readily meaningful to non-experts.

I assure you that, to the extent possible, your replies will be held in strictest confidence. Your letter will be read by the Department of Physics faculty (excluding the candidate), by the College of Arts and Sciences Promotion and Tenure Committee, and by the relevant administrators at Syracuse University.

I realize that this request is an extra burden in your busy schedule. I appreciate the time and effort that goes into writing letters such as this one and thank you in advance for your help in this important endeavor. The opinions of respected outside referees regarding Professor ____'s abilities, accomplishments, and future potential are crucial for both our departmental and college deliberations.

Sincerely,

_____

Professor

Department of Physics

Syracuse University, Syracuse, NY 13244

(315)443-XXXX, email: _____

Link:

*Promotion and Tenure Ballot*

[Date]

Please indicate your vote on the motion, "The Department of Physics recommends that Prof. _____ be granted indefinite appointment with tenure and that he/she be promoted to the rank of associate professor".

☐ Yes
☐ No
☐ Abstain

Comments:

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*Promotion Ballot*

[Date]

Please indicate your vote on the motion, "_____ promoted to the rank of Full Professor at Syracuse University".

☐ Yes
☐ No
☐ Abstain

Comments:

# IV. UNDERGRADUATE DEGREES

The requirements for physics degrees are adopted by the faculty of the Department of Physics, subject to the approval of the College of Arts & Sciences faculty and by the University Senate. While the requirements listed below are copied from the undergraduate and graduate course catalogs as accurately as possible, the catalog versions supersede this text if there is a conflict.

## The Bachelor of Arts in Physics (B.A.)

*Catalog Description*

*Objectives:*

The B. A. degree in physics is an important accomlishment for students considering careers insuch widely varying areas as law, journalism, corporate management, and teaching. In all of these fields a liberal education incorporating serious study of a scientific discipline is an asset. Specific objectives of the physics program include:

- Development of analytical and computaitonal skills through the study of advanced undergraduate physics.
- Development of written and verbal communications skills, incluidn gthe specialized skils requied for the communication of technical informatin.
- Devleopment of a broad understanding of the role of science and technology in modern life.

*Requirements:*

These requirements were approved by the physics faculty at the faculty meeting on 15-September 1999, and by the College and the University Senate in Fall of 1999.

The bachelor of arts degree requires completion of at least 30 credits of physics and astronomy courses. Eight credits of lower-division courses are required:

PHY 211 (or 215) General Physics I (Honors)

PHY 221 General Physics Laboratory I

PHY 212 (or 216) General Physics II (Honors)

PHY 222 General Physics Laboratory II

Eighteen credits of upper division physics and astronomy courses are required, including:

PHY 344 Experimental Physics I

PHY 361 Modern Physics

*Learning Outcomes for the Bachelor of Arts in Physics*

The B.A. degree in physics is a liberal arts degree centered around physics and the associated physical and mathematical sciences. It is designed to prepare students for enlightened citizenship and for a broad spectrum of careers ranging from business and law to medicine and basic science. The specific educational goals of the program are summarized below.

1. Students gain a broad knowledge of physics and the physical sciences. They discover the degree to which the universe is understandable and the extent to which it is in fact understood. They also gain a sense of what questions remain at the forefront of research. Through this process, physics students develop an understanding of the structure of scientific knowledge, how it is obtained, and how it changes.

2. An array of essential communication skills are developed through classwork, course projects, and group work. Students learn to present both broad conceptual overviews and detailed technical information. In particular, the study of physics develops mastery of fine distinctions in language and the ability to communicate without ambiguity.

3. The nature of physics as an experimental science brings students into frequent contact with the idea of acquiring and utilizing new data. They understand that many questions cannot be answered by pure thought alone, but instead require the collection of further information. Students learn to evaluate the reliability of data and to set up situations in which useful information can be collected.

4. Reasoning and evaluation skills are of primary importance to physics. Physics students constantly find that the real world does not conform to their expectations, and that their understanding must be modified. Discovering how they must adjust their outlook requires logical reasoning, mental flexibility, and the ability to work with both qualitative and quantitative information.

5. The combination of theoretical and experimental aspects in physics develops a battery of skills for solving complex problems. Students learn to sort through details to find the issues of central relevance and to develop strategies to deal with these issues. They develop perseverance, creativity, and the ability to use initial failures as a guide to future success.

6. Additionally, there is an educational goal that is not unique to physics, but because of its importance needs to be explicitly stated: We will work to help our students develop the ability to educate themselves.

This version approved by the physics faculty on March 22, 2000 based on the draft submitted by a committee consisting of professors Marina Artuso, Don Marolf, Alan Middleton, and Andreas Wolf.

## The Bachelor of Science in Physics (B. S.)

*College requirements:* The College of Arts & Sciences awards the bachelor of science (B.S.) degree by petition of the degree candidate to the Department and the College. At least 30 credit hours of upper-division courses in the field of study (physics) are required.

### *Catalog Description*

*Objectives:* The B.S. degree is specifically designed to meet the needs of students who will pursue doctoral work in physics or another scientific or engineering discipline. The principal program is modeled on the recommendation of the American Physical Society for students intending to pursue graduate work in physics.

*Department requirements:* 39 credits of physics courses are required for the B. S. degree, including at least 30 credit hours of upper-division courses. Students will also normally take additional chemistry, mathematics, and electrical engineering courses as indicated in the suggested program. A suggested program of study is given below; other programs of study may be developed in consultation with your assigned physics advisor. Petitions for the B.S. degree must be signed either by the Undergraduate Program Director or by the Department Chair. The following is the suggested series of courses in physics and other departments.

*First year:* PHY 215 & 221, PHY 216 & 222; MAT 295, 296.

*Second year:* PHY 361, 322, 344; MAT 397, 485; CHE 106, 116; ELE 291.

*Third year:* PHY 424, 425, 531, 567.

*Fourth year:* PHY 423, 462, 568.

*Learning Outcomes for the Bachelor of Science in Physics*

The Bachelor of Science program is designed to provide an excellent preparation for many fields. The program is designed for students intending to pursue graduate work in physics or a career in a variety of professions where a strong general background in science is useful. The skills a student acquires in this program allow for the pursuit of a rich field of technology related and intellectually oriented career paths.

The educational goals of the Physics B.S. program are for students to gain:

1. Knowledge of the fundamental concepts and discoveries of physics and the relationships between them. The student will gain an appreciation of the history and evolution of scientific knowledge and the way it advances by research, as displayed by the field of physics. This will help students to be able to place specific scientific knowledge in the general context of what has already been learned about the physical world. The student will have an appreciation of some of the existing outstanding problems in physics.

2. The understanding that experimental work is a crucial part of physics in particular and the sciences in general. This understanding includes the ability to make the subtle connections that relate abstract physical concepts and

3. experimental apparatus. Students will gain familiarity with equipment and techniques used for experimental work, including an understanding of the potential abilities and limitations of relevant techniques.

4. The ability to perform theoretical and experimental analyses of problems related to physics. This includes comparing expectations and results from these analyses and concluding success or failure of the predictions made by theories. The student will be able to use the general principles of scientific reasoning, which includes induction from experiment, formulating hypotheses, and extracting predictions from qualitative and quantitative theories.

5. A working familiarity with computational methods. An important part of experimental and theoretical analyses (3) is the use of computational tools, including software packages for graphing, manipulating symbolic expressions, and performing simulations.

6. A mastery of mathematical concepts and tools necessary to understand modern theories from physics. This ranges from the basic understanding of the algebraic formulation of physics concepts to calculus-based analyses of theories and their predictions.

7. Problem solving skills needed to attack problems by oneself and as part of a group. Over the course of this program, many physics related problems are posed in many different contexts. This experience will help students learn how to find the background resources needed to understand a problem, to perform the analyses described above (3) using mathematical and computational methods (4, 5), and how to place the results in context (1).

8. Presentation and communication skills that are important in ongoing scientific work, in disseminating completed work, and in other contexts, such as teaching. These skills include written and oral presentation methods. These skills will be practiced so that the student can communicate scientific ideas concisely, clearly, and with precision.

9. Additionally, there is an educational goal that is not unique to physics, but because of its importance needs to be explicitly stated: We will work to help our students develop the ability to educate themselves.

This version approved by the physics faculty on March 22, 2000 based on the draft submitted by a committee consisting of professors Marina Artuso, Don Marolf, Alan Middleton, and Andreas Wolf.

## Bachelor of Science (B.S.) Degree: Biological and Medical Physics

This program was approved by the Department, College, and Senate in Fall, 1993.

*Introduction*

Sophisticated biophysical technologies are increasingly employed inmedicine and other health professions; examples include ultrasound, computed tomography, magnetic resonance imaging, fiberoptic endoscopy, and laser surgery. Moreover, the rapidly advancing knowledge in the biomedical fields depnds on biophysical concepts and methods, notably electrophysiology, pharmacological kinetics, and biomolecular structure determination. Accordingly, there is need for health care professionals and life scientists with ample training in the physical as well as biological sciences.

The biological and medical physics option under the B.S. program in physics is designed for students who are adept at the mathematical problem solving and conceptual aspects of physics, and who areinterested in careers in biology, biological physics, medical physics, or medicine. Students with demonstrated proficiency inboth physical and biological sciences will have special advantages not only for admission to and performance in graduate and professional schools, but also for their subsequent careers. More specifically, such training would be particularly relevant for the following fields of medicine: cardiology, neurology, opthalmology, and radiology.

The following course sequence and variations meet the general prerequisites for medical school admission established by the Association of American Medical Colleges and also apply for careers in most of the other health professions. Courses in bold face are specifically required for admission to most medical schools.

*Degree Requirements*

Petitions for the B.S. degree must be signed either by the Undergraduate Program Director or by the Department Chair.

*First year:* **PHY 215 & 221, PHY 216 & 222**; MAT 295, 296; **CHE 106 & 107, 116 & 117**.

*Second year:* **BIO 121, 122; CHE 275 & 276, 285 &286**; MAT 397.

*Third year:* PHY 361, 344, 322; BIO 325; CHE 347.

*Fourth year:* PHY 424, 531; MAT 485.

Eight or more credits should be selected from the following courses: BIO 475, 575; ELE 524; MAT 517; PHY 462, 425, 567, 576.

*Learning Outcomes for the Bachelor of Science in Physics:*
*Biological and Medical Physics Option*

This degree option is designed for students with strong interests in the areas of medicine, life sciences, biological physics, or medical physics. It is especially intended for those who plan to obtain an advanced degree in one of these fields.

The goals of this degree option are for the student to acquire:

1. An interdisciplinary background in physics, chemistry, biology, and mathematics. The student will be able to draw from all of these fields when addressing scientific problems. More specifically,

- Students gain knowledge of topics from physics, such as electromagnetism, statistical mechanics, mechanics, and modern physics, that are important to medicine and the life sciences. These topics reflect the emphasis of this option on the physical principles needed to understand more deeply the concepts and tools used in the disciplines of biology and chemistry and fields such as radiology, opthalmology, and neuroscience.

- Students gain knowledge of topics from chemistry and biology, which are important to medicine and the life sciences.

2. Experience in experimental science, including both physical science directly and the use of physical techniques for biological problems.

3. Practical experience in scientific reasoning: answering complex questions about physical, chemical, and biological systems. This experience will often be realized through projects from courses or research outside of formal courses.

4. Strong quantitative problem solving skills. This option emphasizes the application of physical and mathematical concepts to biological problems.

5. Completed courses that meet the general prerequisites for admission to most medical schools.

This version approved by the physics faculty on March 22, 2000 based on the draft submitted by a committee consisting of professors Marina Artuso, Don Marolf, Alan Middleton, and Andreas Wolf.

## The Minor in Physics

To complete a minor in physics, students must take 20 credit hours in physics. PHY 211 or 215, 221, 212 or 216, 222 are required; an additional 12 credits of coursework numbered 300 or above is required.

## Bachelor of Science in Engineering Physics (B.S.)

Faculty members from the Department of Physics may be appointed as program faculty for the engineering physics program of the L. C. Smith College of Engineering and Computer Science. The program of study for the Bachelor of Science (B.S.) degree in engineering physics is adopted by the program faculty subject to the approval of the faculty of the College of Engineering and Computer Science and the University Senate.

*2002-2003 Catalog Description*

Engineering Physics
*Program Director* Marina Artuso, 323 Physics Building, 443-2356, *artuso@suhep.syr.edu.*
*Director Emeritus*: Volker Weiss, 449 Link Hall, 443-3918.
*Faculty* M. Artuso, B.D. Davidson, P.K. Ghosh, P. Kornreich, J.K. Lee, A.J. Levy, J. Lewalle, G.C. Martin, R.W. Perkins Jr., A. Sangani, P. Saulson, E.A. Schiff, J.A. Schwarz, G.Vidali.
The B.S. program in engineering physics is designed for students who want to pursue careers in advanced technology and engineering. Students engaged in this program develop excellent problem-solving skills through the study of fundamentals of physics and mathematics. Thus they will be ready for a variety of careers requiring innovative ideas and able to face the ever-changing challenges of a rapidly evolving technological world. The completion of this program requires the choice of an appropriate concentration that will provide students with a good background in a conventional area of engineering or applied physics. The L. C. Smith College of Engineering and Computer Science offers this program in collaboration with the Physics Department. Examples of the most popular concentrations offered are electrical engineering, microelectronics, material science and applied physics, for example: modern optics (lasers, non-linear optics, etc.), or modern instrumentation. Engineering physics students are encouraged to participate in a variety of research activities in close collaboration with the engineering physics faculty.
ENGINEERING PHYSICS REQUIREMENTS
The core curriculum and the recommended sequence of courses in the engineering physics program are listed below. The program is intentionally flexible to allow consideration of each student's special interest and prior academic

credit (e.g., for students transferring from other programs and institutions). Each student is assigned an academic committee consisting of the program director, a principal advisor from the engineering faculty, and a member of the physics faculty. Formal approval of a student's program by the academic committee is required during the first semester of the student's junior year. Qualified transfer students entering the program during the junior year or later must obtain program approval during the second semester after admission to the program.

ENGINEERING PHYSICS

Mathematics (18) *Credits*
MAT 295 Calculus I .....4
MAT 296 Calculus II .....4
MAT 397 Calculus III .....4
MAT 485 Differential Equations and Matrix Algebra for Engineers .....3
MAT 521 Introduction to Problems and Statistics .....3
118

Sciences (32) *Credits*
CHE 106 General Chemistry I .....3
CHE 107 General Chemistry Lab I .....1
PHY 215 General Physics I.....3
PHY 216 General Physics II.....3
PHY 221 General Physics Lab I.....1
PHY 222 General Physics Lab II .....1
PHY 361 Modern Physics .....3
PHY 322 Intermediate Mechanics I.....3
PHY 344 Experimental Physics I .....4
PHY 423 Intermediate Mechanics II.....3
PHY 531 Thermodynamics and Statistical Mechanics .....3
PHY 567 Atomic Physics and Quantum Mechanics.....4

English/Social Science/Humanities (24)
WRT 105 Writing Studio I.....3
WRT 205 Writing Studio II.....3
Social Science/Humanities Electives.....18

Engineering (35)
ECS 101 Introduction to Engineering and Computer Science.....3
ECS 102 Introduction to Computing .....3
ECS 326 Engineering Materials, Properties, and Processing.....3
ELE 231 Resistive Networks .....3
ELE 291 Electrical Lab I .....1
ELE 324 Electromagnetics I .....3
ELE 325 Electromagnetics II .....3
ENP 498 Senior Design Project .....4
ENP 498 Senior Design Project .....4
MAE 251 Thermodynamics .....4
MAE 341 Fluid Mechanics.....4
Engineering Electives (15) .....15
Free Electives (6).....6
Total Credits .....130

*Footnotes*

1. PHY 215 can be substituted by PHY 211. PHY 216 can be substituted by PHY 212. PHY 322 can be substituted by ECS 221. PHY 423 can be substituted by ECS 222. ENP 498 needs to be repeated for credit to allow the student to pursue a two-semester research project. PHY 322/423 and ECS 221/222 are sequences. Students are strongly encouraged to replace MAT 485 with the sequence MAT 331/514. The number of engineering credits required is consistent with ABET guidelines.
2. The recommended engineering electives are:
*Mechanical Engineering Concentrations:*
ECS 325 Mechanics of Materials (ECS 221 is a prerequisite to this course) (3), MAE 373 Analysis and Design of Structures (4), MEE 471 Synthesis of Mechanical Systems I (3), MEE 472 Synthesis of Mechanical Systems II (3);
*Solid Mechanics*: MAE 421 Dynamics and Control of Mechanical Systems (4), MAE 536 Composite Materials (3), CEN 561 Polymer Science and Engineering (3);
*Fluid Mechanics*: AEE 342 Aerodynamics (4), AEE 446 Propulsion (4), AEE 585 Rocket Propulsion,
*Energy Systems*: MAE 355 Fundamentals of Heat and Mass Transfer, MEE 454 Air Conditioning (3), MEE 551 Energy Conversion (3).
*Electrical Engineering Concentrations:*
ELE 232/ELE 292 El. Engineering Fundamentals II and Ele. Lab. II (3+1), ELE 346 Semiconductor Devices (3), ELE 333 Analog Circuits (3), ELE 331 Digital Circuits and Systems (3), ELE 416 Electromechanical Devices (3), ELE 524 Introduction to Applied Optics (3), CEN 561 Polymer Science and Engineering (3), MTS 581 Xray Diffraction (3).
3. *Recommended Science Electives*:
PHY 307 Science and Computers I (3), PHY 351 Modern Instrumentation (3), PHY 462 Experimental Physics II (4), PHY 576 Introduction to Solid State Physics (3), CHE 116/117 General Chemistry II (3+1).
4. A total of 15 engineering credits, in addition to the required engineering courses, are required.

### *Learning Outcomes for the Bachelor of Science in Engineering Physics*

The Engineering Physics Program is designed for students pursuing research or development careers in advanced technology and engineering. Thus they will be ready for a variety of careers requiring innovative ideas and they will be prepared to face the ever-changing challenges of a rapidly evolving technological world. The completion of this program requires the choice of an appropriate concentration that will provide the student with a good background in a conventional area of engineering or applied physics. The pedagogical philosophy of this program has two key elements:

- The development of basic knowledge in science and engineering that will empower the students with the tools to progress to a variety of more advanced studies in science and technology.

- The pursuit of a more specialized set of skills in an area of their choice in applied physics or engineering research.

The educational goals of the program are summarized below:

1. The students engaged in this program develop excellent quantitative problem solving skills through the study of the fundamentals of physics and mathematics.

2. The broad foundation in science and mathematics prepares the students to learn new techniques or take a leadership role in the opening of new fields of investigation.

3. The interdisciplinary nature of this program atunes the students to the complex nature of modern research, which integrates concepts from several different disciplines.

4. A broad humanities and social science component is designed to enhance the communication skills and awareness of the social issues often intertwined with several areas of industrial research in modern society. This knowledge, combined with a good scientific background, enables the students to make informed decisions on the impact of their scientific or technological work on their community.

5. Research activities are an essential part of this program of studies. In addition to encouraging students to pursue extracurricular research activities, during the senior year the students are required to pursue a semester research project related to their area of concentration. This experience will develop the skills to pursue new problems requiring innovation and creativity. Students will also typically work in a team of two or more. This experience is crucial to develop the teamwork capabilities necessary to succeed in the modern research and industrial worlds.

6. Several activities in this program are geared towards developing good communication skills, through formal presentations to a group of peers and research report writing.

This version was endorsed by vote of the Department of Physics faculty on March 22, 2000; it is based on the draft submitted by a committee consisting of professors Marina Artuso, Don Marolf, Alan Middleton, and Andreas Wolf.

# V. PROCEDURES FOR GRADUATE STUDENTS IN PHYSICS

## Requirements for the Ph.D. in Physics

*These policies are adopted by the faculty of the Department of Physics subject in part to Graduate School and University Senate approval. Dates of original adoption not established. Last revisions adopted 19 November 2014 to the qualifying exam procedure.*

### *Course Requirements*

#### Core Courses

By the end of the second year of graduate study, the student must pass the following courses with at least a B average: PHY 581 (Introduction to Theoretical Physics), PHY 614 (Graduate Lab), PHY 621 (Classical Mechanics), PHY 641/642 (Electromagnetic Theory), PHY 661/662/763 (Quantum Mechanics), and PHY 731 (Statistical Mechanics I).

**Comment [A1]:** Document mixes time-scales (measures of satisfactory progress) with degreee requirements. This really should be fixed: these timelines make no allowances for students who do remedial work, etc..

#### Advanced Courses

The student must have his entire program of study approved by a research committee as described in section 3. Approval will be given only if the program includes appropriate advanced courses (typically 12 to 18 credit hours).

#### Grade Average

An average of at least a B is required for all courses taken.

### *Examinations*

Three examinations are required of a student before awarding of the Ph.D. degree. The three examinations are described below, along with the detailed procedures for the qualifying examination.

#### Comprehensive Examination

Upon arrival at the Physics Department, a new graduate student is expected to take the Comprehensive Examination, which is offered before the start of the fall semester.

> The Comprehensive Examination, which is at the level of undergraduate texts such as Halliday and Resnick, or Tipler's *Physics*, covers the areas of mechanics, electricity and magnetism, heat, optics, and modern physics.

The student will be informed of his/her performance, which will also become part of his/her departmental record. This examination involves no formal passing or failing. Its results may, however, be used by the Department in order to distribute teaching assistantships and/or recommend remedial work.

A student may retake the examination in order to improve his/her record.

#### Qualifying Examination

This important examination, based mainly on the standard first year's graduate course work, is ordinarily taken at the beginning of the student's second year

All students (except those wishing to obtain only a Master's degree via the thesis route) admitted to the graduate program in physics must take the qualifying examination. It is administered only once each year early in the Fall semester. Students are expected to take this examination in the beginning of their second year after matriculation in the physics graduate program. **Students may take the qualifying examination earlier than required; however, they are cautioned to seek their advisors' counsel before making this decision.**

The purpose of the qualifying examination is to determine whether a student has reached a satisfactory level of understanding of four subjects in physics to justify further study towards the Ph.D. degree. The

four subjects are: a) classical mechanics, b) electromagnetism, c) quantum mechanics and d) thermodynamics and statistical mechanics. Only topics normally taught in the first year of graduate course work (presently PHY 621, 641, 661, 662 and 731) and in the prerequisites for these courses will be covered; these topics are briefly described in the appended statement.

Students may petition the physics faculty for exceptions to the rules of the physics department. In particular, a student who fails the qualifying examination may petition the faculty for a second opportunity to take the qualifying examination. The deadline for filing such a petition is two weeks beore the last day of classes of the spring semester. It is the policy of the faculty to grant such a petition for extraordinary reasons only. Consult the Graduate Catalog for additional information.

The administration of the qualifying examination proceeds in the following sequence:

*Written qualifying examination*

This examination will be given at the beginning of the academic year. It will be constructed, administered, and graded by a committee of the faculty appointed by the chair. The committee is charged to grade the examination within a week after it is given, and to recommend, to the faculty, which students should be asked to take the supplementary oral examination.

The examination will be based on the material that is generally covered in courses 621, 641, 661, 662 and 731. The necessary mathematical background as taught in 581 is presumed. The following textbooks and topics specify the general level to be expected.

- Classical Mechanics

  Texts: Goldstein, Corben and Stehle, Saletan and Cromer.

  Lagrangian and Hamiltonian formalisms, canonical transformations, symmetries and conservation laws, rigid body dynamics, normal coordinates and small oscillations.

- Electromagnetism

  Texts: Jackson, Eyges.

  Electrostatics, magnetostatics, boundary value problems, multipole expansions, dielectrics and magnetic materials, Maxwell's equations and their solutions in free space, advanced and retarded potentials.

- Quantum Mechanics

  Texts: Merzbacher; Messiah; Cohen-Tannoudji; Diu and Laloe.

  Fundamental postulates of quantum mechanics, Schrodinger equation and its applications to one, two and three dimensional problems. Abstract formalism. Operator approach to physical problems such as simple harmonic oscillator and angular momentum. Symmetry properties. Identical particles. Spin. Time-independent and time-dependent perturbation theory. Potential scattering. Born approximation. Scattering theory. Partial wave analysis. Variational methods.

- Thermodynamics & Statistical Physics

  Texts: Reif; Pathria; Reichl; Landau and Lifshitz (Part I); Huang.

  Laws of thermodynamics, thermodynamic potentials, thermodynamics of phase transitions, thermodynamic fluctuations and response functions; kinetic theory of gases; Liouville equation; classical ensemble theory: microcanonical, canonical and grand canonical ensembles; density matrix and quantum statistics; ideal Bose gas: Bose-Einstein condensation, superfluidity, phonons

in solids; ideal Fermi gas: electrons in metals; theory of Brownian motion: random walk, Langevin equation, Fokker-Planck equation.

*First faculty meeting*

The chairperson will call a faculty meeting immediately after the grading of the written qualifying examination. This meeting should take place before the deadline for August graduation. At this meeting the faculty may choose to pass some students on the basis of their performance on the written qualifying examination without a supplementary oral examination; these students will be informed by the chairperson of the faculty's decision. The other students who have taken the written qualifying examination will be asked to take an oral qualifying examination to supplement the written examination, provided the performance was at a sufficient level to justify further examination.

*Oral qualifying examination*

An oral qualifying examination committee will be appointed by the chairperson to administer all oral examinations in a given year. This committee will give oral examinations to all students so specified in the first faculty meeting; the committee may use the results from the student's written qualifying examination in selecting topics for the oral examination. The committee is charged to administer these examinations as soon as practicable following the faculty meeting, and to recommend to the faculty an overall passing or failing decision for each student.

*Second faculty meeting*

At this meeting, the faculty decides to pass or fail students on the doctoral qualifying examination based on the results of the oral and written parts. Students who fail the qualifying examination for the Ph.D. may pursue an M.S. degree in physics, but in any event should consult with their advisors. It is expected that the process will be completed and the students notified of the outcome within four weeks of the written examination date.

### Research Oral Examination and Candidacy

Within a year after passing the qualifying examination students are expected to obtain a faculty advisor to supervise their dissertation research. The Research Oral Examination is based on material related to the student's dissertation area and must be taken no later than at the end of the student's third year. The examination is administered by a committee chosen by the student that includes his/her prospective dissertation advisor. A student is formally **"advanced to candidacy"** upon completion of the research oral and all course requirements. Students who do not pass the research oral examination by the end of their third year (or fourth year, for students who have deferred the qualifying examination until their second year) will not be allowed to continue in the Ph.D. program.

The student is required to take an oral examination dealing with the plan for his/her proposed (or a possible) research topic. **The examination must be first attempted before the middle of the third year of graduate study (e.g. end of Fall semester, if student entered in Fall).** The student should have a tentative arrangement for a thesis advisor prior to this examination. The examining committee will consist of three physics faculty members, usually with the tentative thesis advisor as chair. This examining committee is selected by mutual agreement among the student, thesis advisor and the chairperson. The tentative thesis advisor should arrange the examination. The choice of topic for the examination is primarily up to the student, subject to approval of the committee chair.

The student will prepare a short paper on this topic and distribute it to the committee one week prior to the examination. The oral examination will be based mainly on this paper and related questions. The student will be informed of the decision immediately after the examination. Students may exceptionally petition the department to consider a presentation at a research conference in place of the research oral examination, subject to the approval of the student's thesis advisor and the department chair

Oral Dissertation Examination

This examination is based on the contents of the Ph.D. candidate's written dissertation, and is intended to ensure that the dissertation represents independent original research by the candidate at a standard satisfactory to the examination committee. The examination is governed by rules as specified by the Graduate School.

Options for students failing any of the required examinations are deliberated by the faculty.

*Dissertation Credit*

There is a dissertation credit requirement that can be satisfied in either of the following two ways:

- by taking 30 credit hours of PHY 999
- by maintaining "full time" status from the date of matriculation until all other Ph.D. requirements have been completed. Here "full time" means the student takes either at least 12 credit hours, or is a graduate assistant and takes at least 9 credit hours each semester.

*The Waiving of Course Requirements:*

The Graduate Committee of the Department of Physics may waive some of the requirements, if the student is able to establish that he or she possesses equivalent knowledge.

IMPORTANT NOTE

It is desirable that all students make application for a Master's degree, after satisfying the appropriate requirements. See section 3 of "Comprehensive Examination and Master's Requirements." This does not involve any additional requirements for Ph.D. students.

Those students who wish to transfer to the Biophysics, Science Teaching, or Solid State Science and Technology programs should obtain the required information from the respective program directors. It is also possible to be dually enrolled in two graduate programs.

*Research*

After passing the qualifying examination, a student should consult with various members of the faculty who conduct research in the area that the student is most interested in pursuing toward a dissertation. As thesis advising is a highly personal relationship between the two individuals involved, and, as the availability of a particular member of the faculty may be affected by previous commitments, the department cannot guarantee satisfactory arrangements in this respect, even though a student has passed the qualifying examination. Though the physics faculty will try to help in resolving difficulties, finding a thesis advisor must remain the student's responsibility.

After the student has passed the research oral examination, the examining committee will become his/her research committee. The student will meet with the committee at least yearly. At these meetings, the student will report on research progress and plans.

Once the student has prepared his/her dissertation to the satisfaction of the advisor, the student must arrange for the defense. The dissertation must be presented to the Graduate School at least two weeks before the date set for the defense. At that time, the student must have his/her completed program approved by his/her advisor and by the department chairperson. They will then set up a full committee for the final defense and set a date. This committee will include the members of the research committee. The required "second reader" of the dissertation will be designated by the research committee.

## Requirements for the Master's Degree

*These policies are adopted by the faculty of the Department of Physics. Certain aspects are subject to approval by the Graduate School and the University Senate. Dates of adoption not established.*

A minimum of 30 credit hours is required for the Master's Degree. All of these must be in courses numbered 500 or above. These courses must include Physics 581, 614, 621, 641, 661, and 662. A "B" average (3.0) in course work must be maintained for the student to be eligible for a degree.

The degree can be achieved in any of three ways:

- A thesis (involving 6 credit hours of Physics 997) in addition to 24 hours of regular course work.
- 30 hours of course work including a Minor Problem (Physics 890). ~~and passing the Qualifying Examination (see Ph.D. above)~~. (no vote, 11/19/14).
- 36 hours of course work and passing the Qualifying Examination.

Note: Not more than one semester of Physics 690 or 890 (3 credit hours each) can count toward the Master's degree.

The Graduate School requires that a student fill out a Tentative "Program of Study" and a diploma request card. They must be signed by the advisor and the chairperson of the department.

## Support for Graduate Students Enrolled for Physics Degrees

*These policies are established by the Chair of the Department and the Dean of the Graduate School.*

### *General Policy*

(a) Each graduate student will be given a maximum of 6 years of support, in any form, by the university. At the end of the 5th year of support, if he/she still needs a 6th year, the chairperson will send him/her a letter saying that the 6th year will be the last year of support.

(b) An advanced graduate who passes the qualifying examination on arrival will be given a maximum of 5 years of support.

(c) Any faculty member who is serving as advisor for a student, may request that an exception be made for a specific reason.

(d) Note the following requirement from *Academic Rules and Regulations*, 1994-1995: "A candidate for the doctorate who fails to complete his or her dissertation within five years after passing the qualifying examination and who, subsequently, seeks to complete the doctorate will be required to repeat the qualifying examination unless a petition for an extension of time is approved by the Graduate School."

### *Conditions for Continuation as a Teaching Assistant*

As of September 1999, appointment letters for teaching assistants enrolled in physics graduate degree programs contain the following statements regarding the conditions for continuation of a teaching assistantship from the Department of Physics. These conditions also apply to teaching assistants who receive part of their support as research assistants.

"Your graduate teaching assistantship is contingent upon the following understandings. Failure to meet these contingencies or violation of University policies or procedures could result in the termination of your assistantship and/or scholarship.

1. You will perform your assigned assistantship tasks satisfactorily.
2. You will maintain your status as a full-time matriculated status as a graduate student at Syracuse University, and will maintain at least the minimum academic standard (3.0 grade point average) in each term.
3. You will make satisfactory progress toward fulfillment of degree requirements for the program (master's or doctoral) in which you are enrolled. If you wish to register for any courses not offered by

**Comment [A2]:** Revisions:
•Distinction between doctoral and master's program.
•Definition of satisfactory progress: qualifying exam, etc. etc.

the Department, you must obtain the written approval of the Department. Additionally, your principal advisor for thesis research must be a member of the Department of Physics faculty.

4. You will take on no additional work for pay during the period of this assistantship without the written permission of the Department Chair. The combination of your paid work, coursework and scholarly work are considered a full-time assignment.
5. In the event that the Teaching Assistant Program at Syracuse University finds your English language skill is below the standard set for teaching contact with students, you will enroll in recommended English courses and make satisfactory progress towards meeting the student-contact standard. Teaching assistantships may not be renewed for a second year for students who do not meet this standard."

*Evaluation of Graduate Students*

Students are admitted to the Physics Department under the assumption that they can fulfill at least the requirements for a Master's degree. Consequently those students who have been supported in their first year will in general be supported through their second year.

Exceptions to this policy may occur if there are serious problems, for example: inability to maintain at least a 3.0 average in course work, or repeated failure to fulfill requirements of a teaching assignment.

By the beginning of April of each year, the advisor of each graduate student should, and any faculty member may, deliver to the chairperson a report on the student's performance in teaching, research, and courses, with attention primarily to problem areas. Teaching evaluation will be the responsibility of the faculty supervisor for each course and must be provided each semester. Part of this evaluation should rest on observation of teaching performance in the classroom. Collection of teaching, research and course performance comments will be the responsibility of the advisor. Where problems are deemed to exist, the chairperson and advisor should promptly meet with the student. A formal written warning outlining the reasons for possible loss of financial support or matriculation may be issued to the student by the chairperson at this time.

*Continuation of Financial Support/Graduate Matriculation*

In January of each year, there will be a departmental review of all students. The Department will promptly notify those students who have previously been warned (see item 2 above) in case of termination of financial support and/or termination of matriculated status at the end of the semester. Students have the right to appeal the faculty's decision.

*Policy on non-physics Courses*

The following policy was a response to the increased number of graduate teaching assistants enrolled in the physics M.S. and Ph.D. programs who take courses outside the Department of Physics, in particular in the College of Engineering. The policy restricts the number of such courses each year to three for physics degree students supported in part or full as teaching assistants.

"Teaching assistantships awarded by the Department of Physics are used primarily to support students who are seeking the M.S. and Ph.D. degrees in physics. Consistent with this purpose, physics graduate students holding teaching assistantships are expected to restrict the number of (3 credit) courses they take outside of the physics department to one per semester, with one additional (3 credit) course taken over the summer. Although your course program should always be discussed with your advisor, non-physics courses may only be taken with the written approval of your advisor. English courses recommended by the Teaching Assistant program are excepted from these restrictions.

**Comment [A3]:** Problem here – with 6 credit hour courses!

Physics graduate students who take more courses outside the Department than provided for by this policy will be assigned a lower priority in the awarding of teaching assistantships than are students pursuing the M.S. and Ph.D. degrees in physics as their principal activity."

### *Exceptional Circumstances*

The faculty reserves the right to terminate support for a graduate student, and even his/her relationship with the department, for extremely poor academic performance or, in case of exceptional circumstances, where department, college or university regulations have been violated.

# VI. APPENDICES

## Planning Committee

In November 2016, through email and faculty meetings, the purpose of a planning committee and a process for electing one was redefined through email discussion:

> A planning committee helps build a consensus on how to advance the department, in close consultation with all faculty members. It suggests a framework for hiring plans and generates ideas for strategic planning, all for potential adoption by the faculty. The planning committee will be composed of faculty members selected by constituencies. Each constituency will have a representative. The chair of the committee will be chosen by the selected members. In addition, the department chair serves ex officio.

In November, 2016, the six constituencies included a representative of associate and assistant professors, while the other five were organized more or less by research interests.

## Chair Selection and Review

A Chair Review Panel was established in 1984 to review periodically (approximately every two years) the tenure of the Department Chair. This panel was in effect several times. In 2013 and 2016, the Dean chose chair review and search panels. In May 2017, a survey of the faculty resulted in the following procedure for selecting a chair search committee:

> The planning committee members (minus the current department chair) solicit verbal input from the constituencies they represent and then propose a slate of three or four chair search committee members. The individuals on the slate proposed by the faculty committee are each voted on by faculty members. This vote is conducted by the department operations specialist.

Our practice has been: The members of the search committee first receive their charge from the Dean of Arts and Sciences. The committee then conducts interviews with department staff and faculty. The committee brings an unranked list of chair candidates to the faculty for approval to communicate to the Dean. The committee also reports directly to the Dean.

## Peer review of teaching

(See following pages.)

# Memorandum

**Syracuse University**
**College of Arts & Sciences**
**Department of Physics**

**To:** Physics Faculty

**From:** Eric A. Schiff, Chair

**Date:** October 17, 2001

**Re:** Peer and Student Review of Teaching

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In this memo I remind you that the College of Arts & Sciences requires "peer review of teaching" (review by another faculty member) in promotion and tenure cases; peer review is in addition to the better-known expectation for student reviews. I think essentially everyone who has undertaken peer review of teaching has found it to be valuable, and I recommend it to all faculty members. I suggest the following procedure for obtaining peer reviews and student reviews.

Professors should obtain both student and peer reviews of each course they teach. As a minimum, student reviews should consist of a survey of the students enrolled. The survey should employ a form developed by the department's assessment coordinator (currently Simon Catterall); this form makes allowances for you to add questions beyond the standard ones employed for all classes. The survey should, of course, be administered so that a large fraction of the students enrolled complete the survey. The undergraduate secretary (currently Arlene Johnston) will help prepare the survey and arrange for the multiple-choice and written sections to be summarized.

As a minimum, peer review should be based on a meeting with a faculty member (the peer reviewer) chosen by the professor. The agenda of this meeting should include the following items:

- the written syllabus for the course (including course objectives, curriculum, text, grading, etc.)
- the pedagogical methods used and their effect; if possible and desired by the instructor, the peer reviewer should do an advance class visit to support this portion of the peer review.
- examinations, grade curve and grading procedure, and other assessments of student performance (such as the Force Concept Inventory).
- student surveys
- When appropriate, management of teaching assistants and results of teaching assistant surveys.

The peer reviewer should address a memo to the instructor summarizing the meeting as well as any "action items"; the department chair should receive a copy. This peer review memo will serve as documentation of the peer review process; the memo should not be used to rate or grade the instructor. With Simon Catterall's permission, I have attached a copy of the peer review I did some years ago for him. I have no doubt that better peer reviews have been done since then, but this will serve to indicate the style I consider suitable.

**Comment [A4]:** Should a peer-review template be developed to substitute for this memo?

# Memorandum

**Syracuse University**
**College of Arts & Sciences**
**Department of Physics**

**To:** Simon Catterall

**From**: Eric A. Schiff

**Date:** September 2, 2017

**Re:** Peer Review of "Science & Computers," PHY 307

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This written peer review is a summary of discussions we have had regarding PHY307, most recently on June 3, 1998. This review is NOT intended to rate or grade your teaching in a positive or negative manner, but is to record the contents of our critical discussion on possible approaches to maintain or improve the quality of the course and to review its place in our curriculum. You have been the instructor of this course in Fall 1996 and Fall 1997, and are scheduled to teach it again this coming Fall. This course is a relatively new one for our department, and you are its first instructor.

We reviewed your student surveys from last Fall. Most students seems satisfied with your explanations of the course material and with the improvement in their computer skills as a result of taking the course. In addition, your emphasis on the use of "computer labs" as a substitute for lectures was well received. We discussed the inadequacies of the computer cluster in the physics building for this purpose. These include (i) the physical arrangement of the computers, which prevents the instructor from seeing the students' activities while leading the lab, (ii) the difficulties in excluding non-enrolled students from using the many free computers in the cluster during a laboratory session, and (iii) the poor facilities for projection of computer displays. There have also been recurring problems in getting essential software loaded onto the cluster computers -- and most importantly the JAVA development kit (JDK). One possible solution we discussed would be to locate a physically more suitable cluster in another building.

The results on the survey question "would you recommend this course?" were also positive. Given our ambition to use this course to help recruit physics majors, it seemed useful to see what could be done to get even stronger recommendations than for last Fall. You are recommending two substantial modifications for your next offering of this course. One would be to focus on a single technical avenue (all exercises done in JAVA or C, as opposed to doing some work in Maple, some in C, and some in JAVA); this seemed sound to me also. The second would be to reduce the number of physical examples taught. Last year you taught topics including the pendulum, the chaotic driven pendulum, chaos, the quantum oscillator, planetary orbits, and perturbed planetary orbits. For the next offering you would focus on one or two broad themes, and might introduce popular readings (such as James Gleick's book *Chaos*) to help motivate your students.

For the next year we discussed a wide range of possible topics; Alan Middleton contributed to this conversation. The list included chaos (satellite orbits, weather, acoustics, pendula), quantum mechanics (measurements, lasers, coherence), financial physics (black shoals, etc.), biological physics (molecular motors or protein folding), automata (traffic problems, organisms), relativity (Lorentz contraction, black holes), the spatial structure of the universe, nuclear weapons, astrophysics, and health physics (sickle cell anemia). The relativity topic may conflict with PHY 312.

We discussed whether orbital motion of satellites might be a large enough topic to serve as the theme for the entire semester. The course would include the normal elliptical orbits of satellites, the effects of changing Newton's gravitational law on orbital motions (such as for general relativistic effects), and chaotic orbits observed when three different masses are involved. We discussed the possible advantages of teaching elementary topics (such as the orbital period vs. the radius of an orbit) using computer animation as well as algebraic expressions. A possible project might be for a student to figure out how to get a spacecraft to Mars. Another project might be to decide whether life could evolve on a planet orbiting a double star system.

Finally, we discussed the written description of course objectives in the syllabus for the course. You might consider elaborating a little more in this area, primarily as a way of articulating the objectives more clearly for your own use, but also because (in my experience) students appreciate clear statements of this kind. Presumably you would use this opportunity to clarify the emphasis given to the two aspects of your course: the need to teach computational technique, and to teach topics in science which computers can illuminate.