



Program Approval Form

For approval of new programs and deletions or modifications to an existing program.

Action Requested:

- Create New (SCHEV approval required except for minors)
- Inactivate Existing
- Modify Existing (check **ALL** that apply)

- Title (SCHEV approval required except for minors)
- Concentration** (Choose one): Add Delete Modify
- Degree Requirements
- Admission Standards/ Application Requirements
- Other Changes: _____

Type (Check one):

- B.A. B.S. Minor (req. C3 approval)
- M.A. M.S. M.Ed.
- Ph.D.
- Undergraduate Certificate* (req. C3 approval)
- Graduate Certificate*
- Bachelor's/Accelerated Master's Other:

College/School: **Department:**
Submitted by: **Ext:** **Email:**

Effective Term: Fall **Please note:** For students to be admitted to a new degree, minor, certificate or concentration, the program must be fully approved, entered into Banner, and published in the University Catalog.

Justification: (attach separate document if necessary)

Program Title: (Required)
 Title must identify subject matter. Do not include name of college/school/dept.

Concentration(s):

Admissions Standards / Application Requirements: (Required only if different from those listed in the University Catalog)

Degree Requirements:
 Consult University Catalog for models, attach separate document if necessary using track changes for modifications

Courses offered via distance:
 (if applicable)

TOTAL CREDITS REQUIRED:

Existing	New/Modified
Physics	Physics
none	Standard Concentration Engineering Physics Concentration
See attachment	See attachment
72	72

*For Certificates Only: Indicate whether students are able to pursue on a Full-time basis Part-time basis

Approval Signatures

Department _____ Date _____ College/School _____ Date _____ Provost's Office _____ Date _____
Required for Minors and Interdisciplinary Programs

If this program may impact another unit or is in collaboration with another unit at Mason, the originating department must circulate this proposal for review by those units and obtain the necessary signatures prior to submission. Failure to do so will delay action on this proposal.

Unit Name	Unit Approval Name	Unit Approver's Signature	Date

For Minors and UG Certificates only (Cross-College Curriculum Committee Approval)

C3 Committee Member _____ Provost Office _____ C3 Committee Approval Date _____

For Graduate Programs Only

For Registrar Office's Use Only: Received _____ Banner _____ Catalog _____ revised 7/1/15

Program Proposal Submitted to the College of Science Curriculum Committee (COSCC)

The form above is processed by the Office of the University Registrar. This second page is for the COSCC's reference. Please complete the applicable portions of this page to clearly communicate what the form above is requesting.

FOR ALL PROGRAMS (required)

Program Title: Physics, PhD

Date of Departmental Approval: October 7, 2016

FOR MODIFIED PROGRAMS (required if modifying a program)

- Summary of the Modification:

PhD Program in physics is expanded to contain two concentrations: Standard Concentration and Engineering Physics Concentration. The Standard Concentration keeps the same curriculum requirements as these in the current Physics PhD Program. The proposed Engineering Physics Concentration has special curriculum requirements due to the interdisciplinary nature of the concentration.

- Text before and after Modification on **Degree Description:**

Existing Degree Description:

Banner Code: SC-PHD-PHYS

This program of study is offered by the Department of Physics and Astronomy in the College of Science.

All doctoral students accepted into the Physics, PhD take a common core of four courses (see below). By working with the dissertation committee, a student may choose to specialize in an emphasis area such as astrophysics, biophysics, nonlinear physics, planetary sciences, material physics, space weather physics, or others according to his or her particular interests. By the end of their first year, all students should pair with a faculty advisor who will guide them toward doctoral candidacy.

New Degree Description:

Banner Code: SC-PHD-PHYS

This program of study is offered by the Department of Physics and Astronomy in the College of Science.

The degree program contains a Standard Concentration for traditional physics programs that focus on Astrophysics, Condensed Matter Theory, Dynamical Systems/Biological Physics, High Energy Physics, Materials Physics, Space Sciences, and an Engineering Physics Concentration that combines the disciplines of physics, mathematics, and engineering. The doctoral students accepted into each concentration of the physics PhD program take a required set of core courses for the given concentration (see below).

By working with the Dissertation Committee, a student in the Standard Concentration may choose to specialize in an emphasis area such as Astrophysics, Condensed Matter Theory, Dynamical Systems/Biological Physics, High Energy Physics, Materials Physics, Space Sciences, or others according to his or her particular interests. A student in the Engineering Physics Concentration may choose to specialize

in Applied Mechanics, or other applied and engineering physics areas. By the end of their first year, all students should pair with a faculty advisor who will guide them toward doctoral candidacy.

- Text before and after Modification on **Degree Requirements:**

Required Coursework (48 credits)

The required 48 credit hours of course work are divided into the following four categories:

- a. Core Courses (12 Credits)
- b. Specialty Science Courses (6 Credits)
- c. Seminar (3 Credits)
- d. General Science Electives (27 Credits)

Existing Core (12 credits)

PHYS 684 - Quantum Mechanics I Credits: 3
PHYS 685 - Classical Electrodynamics I Credits: 3
PHYS 705 - Classical Mechanics Credits: 3
PHYS 711 - Statistical Mechanics Credits: 3

New Core (12 credits)

Standard Concentration

PHYS 684 - Quantum Mechanics I Credits: 3
PHYS 685 - Classical Electrodynamics I Credits: 3
PHYS 705 - Classical Mechanics Credits: 3
PHYS 711 - Statistical Mechanics Credits: 3

Engineering Physics Concentration

PHYS 690 Engineering Thermodynamics (or PHYS 711 Statistical Mechanics) Credits: 3
PHYS 620 Continuum Mechanics (or PHYS 705 Classical Mechanics) Credits: 3
PHYS 510 Computational Physics I Credits: 3
PHYS 613 Computational Physics II Credits: 3

Existing Specialty Science Courses (6 credits)

Students must complete two out of the following four physics and astronomy electives:

PHYS 784 - Quantum Mechanics II Credits: 3
PHYS 785 - Classical Electrodynamics II Credits: 3
ASTR 680 - Physics of Interstellar Media Credits: 3
ASTR 730 - Stellar Astrophysics Credits: 3

These electives must be approved by the student's advisor or the graduate coordinator.

New Specialty Science Courses (6 credits)

Standard Concentration

Students in this concentration must complete two out of the following four physics and astronomy electives:

PHYS 784 - Quantum Mechanics II Credits: 3

PHYS 785 - Classical Electrodynamics II Credits: 3
ASTR 680 - Physics of Interstellar Media Credits: 3
ASTR 730 - Stellar Astrophysics Credits: 3

These electives must be approved by the student's advisor or the graduate coordinator.

Engineering Physics Concentration

Students in this concentration must complete two out of the following four physics electives:

PHYS 640 - Finite Element Analysis of Solids and Fluids Credits: 3
PHYS 694 - Applied Mechanics of Solids Credits: 3
PHYS 695 - Applied Fluid Mechanics Credits: 3
PHYS 684 - Quantum Mechanics I Credits: 3
PHYS 685 - Classical Electrodynamics I Credits: 3

These electives must be approved by the student's advisor or the graduate coordinator.

Current Seminar (3 credits)

PHYS 703 - Seminar in Physics Credits: 1 (must be taken three times)

New Seminar (3 credits)

Standard Concentration

PHYS 703 - Seminar in Physics Credits: 1 (must be taken three times)

Engineering Physics Concentration

Graduate PHYS/CEIE/MECH/MATH/CSI seminars with at least one credit PHYS 703, Seminar in Physics.

Current General Science Electives (27 credits)

27 credits of approved general electives and preliminary research credits:

ASTR 796 - Directed Reading and Research Credits: 1-12
ASTR 798 - Research Project Credits: 3
PHYS 796 - Directed Reading and Research Credits: 1-12
PHYS 798 - Research Project Credits: 3

Note: PHYS 796/ASTR 796 may be repeated as needed. General electives may be any graduate-level courses chosen from physics, astronomy and/or other related disciplines approved by the student's advisor or the graduate coordinator.

New General Science Electives (27 credits)

Students in both Standard Concentration and Engineering Physics Concentration need to complete 27 credits of approved general electives and preliminary research credits:

ASTR 796 - Directed Reading and Research Credits: 1-12
ASTR 798 - Research Project Credits: 3
PHYS 796 - Directed Reading and Research Credits: 1-12
PHYS 798 - Research Project Credits: 3

Note: PHYS 796/ASTR 796 may be repeated as needed. General electives may be any graduate-level courses chosen from physics, astronomy and/or other related disciplines approved by the student's advisor or dissertation committee.

- Text before and after Modification on **Qualifying Examinations:**

Existing Qualifying Examinations:

All students must successfully pass the four individual sections (quantum mechanics, electromagnetic theory, classical mechanics, and statistical mechanics) of a qualifying examination. The four topics in the qualifying exam are covered in the four core courses (PHYS 684, PHYS 685, PHYS 705, and PHYS 711). All four sections of the qualifying exam will be offered twice a year, typically in the week before the start of the fall and spring semesters. A student can choose to take a particular section or a combination of sections at one sitting. Grades of "pass" or "unsatisfactory" will be given individually for each of the four sections of the exam. If a student receives a grade of "unsatisfactory" in a given section of the exam, he/she is allowed to retake that section in the next cycle but a student must satisfactorily pass all sections of the exam by the end of the third year from the date of enrollment in the PhD program. Students entering the program with equivalent courses taken at another institution can satisfy the core requirement by taking the qualifying exam without taking the course.

At the beginning of each academic year, the program director will appoint members to the qualifying examination committee. This committee is responsible for creating, administering, and grading the qualifying exams offered that year. Additional information and previous qualifying exams can be found [here](#).

New Qualifying Examinations:

All students must successfully pass the four individual sections required for each concentration of a qualifying examination. For the Standard Concentration, the four topics on the qualifying exam are covered in the four core courses (PHYS 684, PHYS 685, PHYS 705, and PHYS 711). For the Engineering Physics Concentration, the four topics on the qualifying exam are covered in the four core courses (PHYS 690 or PHYS 711, PHYS 620 or PHYS 705, PHYS 510 and PHYS 613) and in one of the specialty science courses (PHYS 694 or PHYS 695).

All four sections of the qualifying exam will be offered twice a year, typically in the week before the start of the fall and spring semesters. A student can choose to take a particular section or a combination of sections at one sitting. Grades of "pass" or "unsatisfactory" will be given individually for each of the four sections of the exam. If a student receives a grade of "unsatisfactory" in a given section of the exam, he/she is allowed to retake that section in the next cycle, but a student must satisfactorily pass all sections of the exam by the end of the third year from the date of enrollment in the PhD program. Students entering the program with equivalent courses taken at another institution can satisfy a core course requirement by taking the associated qualifying exam without taking the course.

At the beginning of each academic year, the program director will appoint members to the qualifying examination committee. This committee is responsible for creating, administering, and grading the qualifying exams offered that year. Additional information and previous qualifying exams can be found on the departmental web page.

- Text before and after Modification on **Dissertation Committee:**

No change of Dissertation Committee.

- Text before and after Modification on **Advancement to Candidacy:**

No change on Advancement to Candidacy.

- Text before and after Modification on **Doctoral Dissertation:**

No change on Doctoral Dissertation.

- Reason for the Modification:

PhD Program in Physics is offered by the Department of Physics and Astronomy in the College of Science. The current Physics PhD program does not have concentrations.

Engineering physics refers to the study of the combined disciplines of physics, mathematics and engineering in order to develop an enhanced understanding of the interrelationship between them. The MS Program in Applied and Engineering Physics offered by the Department of Physics and Astronomy has one area of emphasis in Engineering Physics. In order to attract these MS students and other students with MS degree in Engineering to Physics PhD Program, it is necessary to add an Engineering Physics concentration in the current Physics PhD Program. In addition, the re-established Physics and Astronomy Department has five faculty members with strong research in one of the Engineering Physics specialty, Applied Mechanics. There has been a growing interest from students in Engineering Physics since the re-establishment of the department in Fall 2015.

Adding a new concentration in Engineering Physics in the current Physics PhD Program will expand the current program. The modified PhD Program will thus consist of two concentrations: Standard Concentration and Engineering Physics Concentration. The Standard Concentration will keep the same curriculum requirements as these in the current Physics PhD Program. The Engineering Physics Concentration will have special curriculum requirements due to the interdisciplinary nature of the concentration.