# **Applied Mathematics and Mathematical Physics PhD**

# **Objectives**

This program is designed for students interested in research careers in mathematics in the military, industry or government. It also prepares individuals to teaching and/or do research at college.

# **Admission Requirement**

All applicants must submit to the Director of Graduate Programs, Department of Mathematical Sciences, their Graduate Record Examination scores, three letters of references from professionals in the area of interest of the applicant, and transcripts from all colleges attended. A minimum of 3.0 on a scale of 4.0 overall and in the courses related to the field of the Ph.D. is required.

### **APPLIED MATHEMATICS CONCENTRATION**

Students who desire to enter the Applied Mathematics concentration with Master?s degree must have successfully completed the following courses, by examination or by successfully completing the graduate courses with a grade of B or above: Abstract Algebra, Real Analysis, and Complex Analysis. Depending upon the student?s educational background, some students may also be required to take some master level graduate mathematics courses.

Students who desire to enter the Imaging Applied Mathematics concentration from baccalaureate degree must have successfully completed the following courses, by examination or by successfully completing the undergraduate courses: Advanced Calculus I, Linear Algebra, Statistics, Probability, and Algebraic Structures I. The plan of study for this scenario will be agreed upon by the student, his/her advisor, and the Graduate Committee, Department of Mathematical Sciences. Depending upon the student?s educational background, some students may also be required to take some undergraduate mathematics courses.

#### MATHEMATICAL PHYSICS CONCENTRATION

Students who desire to enter the Mathematical Physics concentration with Master?s degree in physics or a related area must have successfully completed the following courses, by examination or by successfully completing the graduate courses with a grade of B or above: Thermodynamics and Kinetic Theory, Classical Mechanics, Advanced Electromagnetic Theory, and Quantum Mechanics. Depending upon the student?s educational background,

some students may also be required to take some masters level graduate mathematics and physics courses.

Students with baccalaureate degrees may enter the mathematical physics concentration with the approval of the Graduate Committee. Depending upon the student?s educational background, some students may also be required to take some undergraduate mathematics and physics courses.

# **Graduate Assistantship and Fellowship**

Graduate research or teaching assistantships and fellowships are available. Detailed information and application forms may be obtained from the Applied Mathematics Research Center, or the Department of Mathematical Sciences.

# Curriculum

The Ph.D. program in interdisciplinary applied mathematics and mathematical physics is flexible enough to accommodate students with diversified backgrounds. In consultation with the Director of Graduate Programs, each student develops a course of study in applied mathematics (Applied Mathematics concentration) or physics (Mathematical Physics concentration) whichever is most relevant to his/her professional and career objectives.

# Ph.D. Requirements

Courses and Qualifying Examinations

#### I. CONCENTRATION A: APPLIED MATHEMATICS

A student who enters the program with a baccalaureate degree must complete his/her Master?s degree in the related area. Students who have Master?s degrees with no prior Ph.D. graduate course work must complete 30 credit hours of graduate level courses listed below. In addition at least 9 credit hours of research on dissertation are required. A G.P.A. of 3.0 on a 4.0 scale or above must be maintained.

The program requires the Ph.D. candidate to have reading knowledge of at least one foreign language approved by the Director of Graduate Programs.

## Required Courses (12 Credit Hours)

MTSC-863	Functional Analysis	3 Hours
MTSC-861	Real Analysis	3 Hours
MTSC-871	Complex Analysis	3 Hours

### One of the following two courses:

MTSC-887	Image Processing	3 Hours
MTSC-821	Scientific Computation I	3 Hours

### Electives (18 credit hours)

Students may take an additional 18 credit hours from the list of elective courses to satisfy the credit hours requirement with the approval of the student's advisor. Students must take any two of the following courses:

PHYS-657	Mathematical Methods	3 Hours
MTSC-885	Computational Geometry	3 Hours
PHYS-671	Advanced Electromagnetic Theory	3 Hours
MTSC-883	Wavelet Analysis	3 Hours

### **Qualifying Examinations**

Upon completing the course requirement, each student must successfully pass two written examinations. One examination is based on two courses selected by the student from Functional Analysis, Real Analysis and Complex Analysis. The other examination is based on two courses selected by the student from Image Processing, Mathematical Methods, Advanced Electromagnetic Theory, Computational Geometry, Wavelet Analysis, Numerical Analysis and Scientific Computation I and courses approved by the Graduate Committee. A student must pass an oral examination on a subject area directly related to his/her dissertation.

#### II. CONCENTRATION B: MATHEMATICAL PHYSICS

A student who enters the program with a baccalaureate degree must complete his or her Master?s degree in the related area. Students who have Master degrees with no prior Ph.D. graduate course work must complete 39 credit hours of graduate level courses listed below. In addition at least 9 credit hours of research on dissertation are required. A G.P.A. of 3.0 or above on a 4.0 scale must be maintained.

The program requires the Ph.D. candidate to have reading knowledge of at least one foreign language approved by the Graduate Committee. Each candidate is required to take a foreign language reading in mathematics or physics approved by Department of Mathematical Sciences.

A sequence of core courses required by all Ph.D. candidates includes the following: PHYS-665 Statistical Mechanics, PHYS-672 Advanced Electromagnetic Theory, PHYS-676 Quantum Mechanics, PHYS-655 Computational Methods, MTSC-863 Functional Analysis or MTSC-857 Integral Equations, and MTSC-871 Complex Analysis. Any student found deficient in any of these areas may be required to take appropriate courses to remove that deficiency.

### Required Courses (18 credit hours)

PHYS-655	Computational Methods	3 Hours
PHYS-665	Statistical Mechanics	3 Hours
PHYS-672	Advanced Electromagnetic Theory	3 Hours
PHYS-676	Quantum Mechanics	3 Hours
MTSC-863	Functional Analysis	3 Hours
MTSC-871	Complex Analysis	3 Hours

## Electives (12 credit hours)

Students may take an additional 12 credit hours from the list of elective courses to satisfy the credit hours requirement with the approval of the student's advisor.

## **Qualifying Examinations**

Each student must successfully pass the written general examination in physics which encompasses the area of Thermodynamics and Kinetic Theory, Classical Mechanics, Advanced Electromagnetic Theory, and Quantum Mechanics. In addition, a student must pass an oral examination on a subject area chosen by his/her advisor.

#### **Elective Courses:**

MTSC-821	Scientific Computation I	3 Hours
MTSC-822	Scientific Computation II	3 Hours
MTSC-833	Stochastic Processes	3 Hours
MTSC-853	Partial Differential Equations	3 Hours
MTSC-867	Numerical Analysis	3 Hours
MTSC-851	Ordinary Differential Equations	3 Hours
MTSC-885	Computational Geometry	3 Hours
MTSC-857	Integral Equations	3 Hours
MTSC-875	Inverse Problems	3 Hours
MTSC-887	Image Processing	3 Hours
MTSC-811	Abstract Algebra	3 Hours
PHYS-655	Computational Methods	3 Hours
PHYS-665	Statistical Mechanics	3 Hours
PHYS-671	Advanced Electromagnetic Theory I	3 Hours
PHYS-672	Advanced Electromagnetic Theory II	3 Hours
PHYS-652	Classical Mechanics	3 Hours
PHYS-657	Mathematical Methods	3 Hours
PHYS-661	Solid State Physics	3 Hours
PHYS-675	Quantum Mechanics	3 Hours
MTSC-883	Wavelet Analysis	3 Hours
MTSC-889	Topics in Applied Mathematics	3 Hours

#### Dissertation

Each student must select or have assigned by the Ph.D. Program Committee, two dissertation advisors, one in mathematics and one in physics or a related applied area. The most important requirement for the Ph.D. degree is the satisfactory completion of a scientific investigation, and the writing of a dissertation on that investigation represents a significant contribution to the research literature. Each student must complete a dissertation with his/her dissertation advisors and successfully defend the dissertation before his/her Ph.D. Program Committee of five members including one external examiner.

MTSC-890	Dissertation	3-9 Hours
Sustaining S	Status	

Once a student has completed all the course requirements, passed the Qualifying Examinations, met the language requirements, and registered for 9 credits of dissertation (MTSC-890), but has not completed his/her dissertation, then the student is required to maintain his/her matriculation in the degree program by registering for Doctoral Sustaining (MTSC-899). A student must be registered in the semester in which the degree is awarded.

MTSC-899 Doctoral Sustaining 0 Hours

## Department Homepage[1]

Source URL: http://desu.edu/applied-mathematics-and-mathematical-physics-phd

#### Links:

[1] http://www.desu.edu/department-mathematics