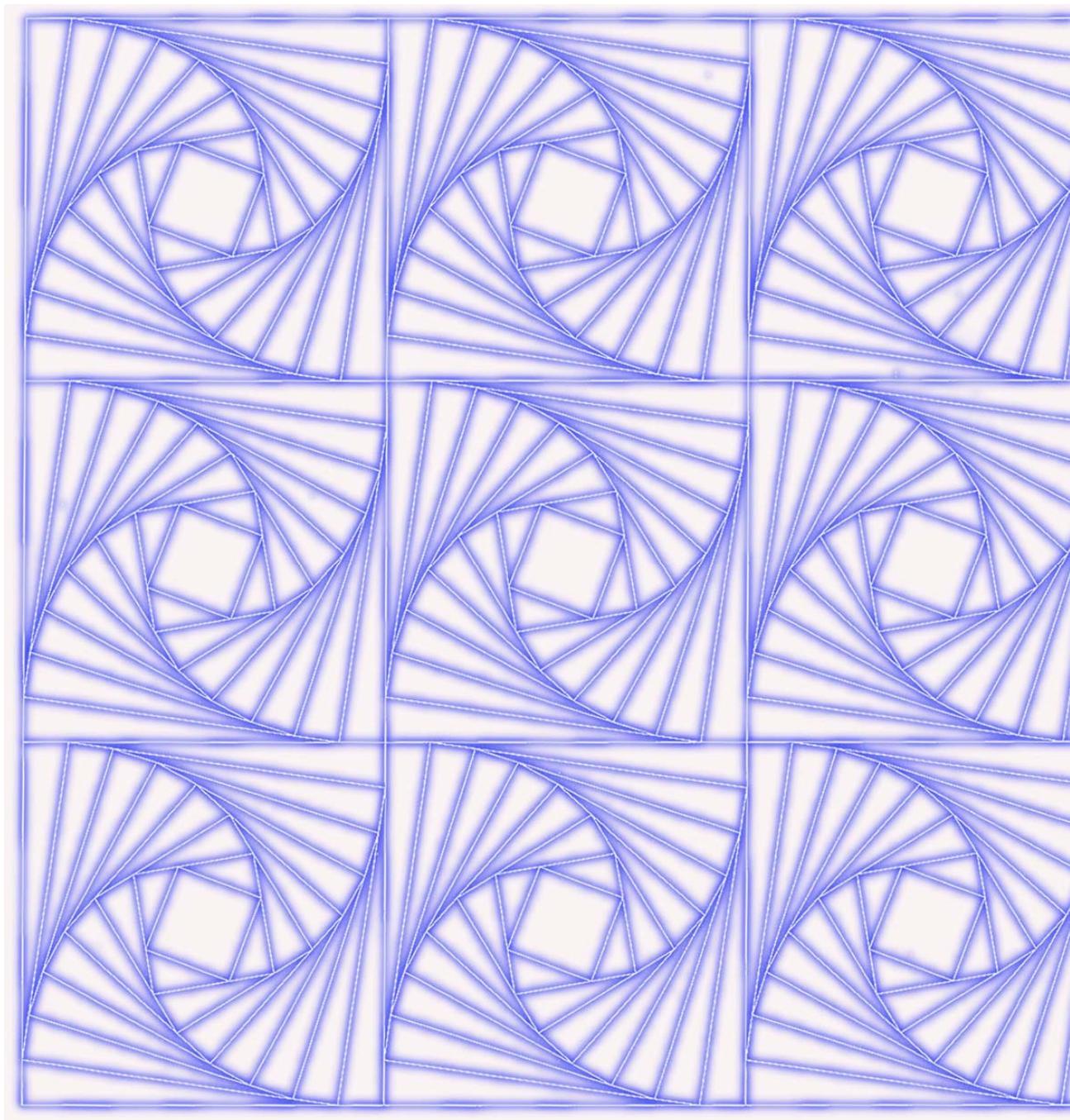


# MATHEMATICS

Undergraduate Program



2011-2013

THE DEPARTMENT OF MATHEMATICS  
UNIVERSITY OF SOUTH CAROLINA—COLUMBIA

## **FURTHER ASSISTANCE IS AVAILABLE FROM:**

**Dr. Douglas Meade**  
**Undergraduate Director**  
LeConte 300E  
Phone: 777-5313  
E-mail: [ugraddir@math.sc.edu](mailto:ugraddir@math.sc.edu)

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Phone: 777-4225  
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**Assistant Chair**  
LeConte 300C  
Phone: 777-6190  
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**Dr. Loren W. Knapp**  
**Assistant Dean**  
Flinn Hall  
Phone: 777-2505  
E-mail: [lwknapp@cas.sc.edu](mailto:lwknapp@cas.sc.edu)

**Dr. Ognian T. Trifonov**  
**Graduate Director**  
LeConte 411  
Phone: 777-4224  
E-mail: [graddir@math.sc.edu](mailto:graddir@math.sc.edu)

### **MT and MAT Advisors Department of Education**

**Dr. Edwin Dickey**  
Wardlaw 226  
Phone: 777-6235  
E-mail: [ed.dickey@sc.edu](mailto:ed.dickey@sc.edu)

**Dr. Jan Yow**  
Wardlaw 224  
Phone: 777-2472  
E-mail: [yow@mailbox.sc.edu](mailto:yow@mailbox.sc.edu)

Note: *Students interested in the Master of Arts in Teaching (MAT) degree may also obtain information from the Department of Mathematics Graduate Director.*

## **IMPORTANT USC WEBSITES**

University of South Carolina	<a href="http://www.sc.edu/">http://www.sc.edu/</a>
College of Arts and Sciences	<a href="http://www.cas.sc.edu/">http://www.cas.sc.edu/</a>
Department of Mathematics	<a href="http://www.math.sc.edu/">http://www.math.sc.edu/</a>
Blackboard	<a href="https://blackboard.sc.edu/">https://blackboard.sc.edu/</a>
Academic Success	<a href="http://www.sc.edu/academicsuccess/">http://www.sc.edu/academicsuccess/</a>
Supplemental Instruction	<a href="http://www.sa.sc.edu/supplementalinstruction/">http://www.sa.sc.edu/supplementalinstruction/</a>
VIP	<a href="https://vip.sc.edu/">https://vip.sc.edu/</a>

## **STUDENT PROGRESS REPORT**

The **Student Progress Report** is a degree requirement evaluation that has been prepared to assist in determining student academic progress. It is not a transcript or an official USC record. Efforts have been made to ensure its accuracy; final responsibility for meeting requirements resides with the student.

To access the Student Progress Report on DARSWeb, log onto VIP and select the “Undergraduate Student Progress Report” tab.

# A GUIDE FOR UNDERGRADUATE MAJORS IN MATHEMATICS

## ***WHAT IS MATHEMATICS***

Did you ever notice those little whirlpools, or vortices, that are swept downstream from the piers of a bridge, or that spin off the end of your oar when you are rowing a boat? That same thing happens in the slipstream of a car or an airplane, or in the wind blowing past a tall building. In some instances, it may be a small effect, but at higher velocities, they may affect the drag on a car or an airfoil and in extreme cases, the resonance produced may be large enough to bring down bridges or the cooling towers of a power station. In studying the case of a wind tunnel or any other situations, a scale model has to be built and modified every time changes are desired.

Here is where the mathematics comes in; we build a mathematical model. The only real construction that goes on here is in our minds. By formulating the mathematical equations that govern the process, we can attempt to solve them mathematically to obtain a description of what will happen in the real world. This is not always an easy process. Often the models have to be so complicated to take into account all the factors involved that solving them explicitly is impossible. However, sophisticated mathematical techniques can be used to generate approximate solutions on high-speed computers. The mathematics allows us to build the model, to go as far as we can with theoretical means to solve it, to organize it in a suitable form for computer processing, and to analyze the results. Frequently, the results obtained provide new insights into the mechanisms involved, thereby enabling the mathematical model to be improved.

The process is called computer simulation. It is used extensively in the design of automobiles and airplanes, in energy resource discovery and recovery, and to understand complex industrial processes such as chemical reactions or the reactions that occur inside a nuclear reactor. This is mathematics at work. Remember that the computer only does what it is told to do (very quickly, of course), and so highly trained mathematical scientists, teamed with specialists from other areas, are essential to the success of such ventures. Industry is increasingly turning to mathematical modeling and computer simulation as the primary tools in its research and development operations, particularly since the advent of the supercomputer.

Does all of mathematics require the use of a computer? Not at all, but the process of discovery in any area of mathematics is similar to that in modeling and simulation. The problem is formulated in mathematical terms, modeled, analyzed, perhaps only partially resolved, modified, analyzed again, and so on, until a solution is obtained. And all of science is so inherently mathematical that expertise in mathematics is essential nowadays in virtually every branch of science and engineering, and even in business administration and the social sciences. Mathematics is indeed the language of science, the universal means of expression, and the source of communication between diverse disciplines.

## ***CAREER OPPORTUNITIES IN MATHEMATICS***

In today's world of rapidly expanding technology, there are many career opportunities for the well-qualified mathematician. Business, government, and industry have strong needs for mathematicians in areas such as operations research, optimization, numerical analysis, computer programming, systems analysis, communications, statistics, and information and actuarial science. Whether it be in operations research, systems analysis, computer software and hardware development, modeling and simulation, numerical analysis, development and test of algorithms, cryptology, or teaching, some familiarity with computers and the mathematics of computation is usually essential. The mathematics degree, at the baccalaureate, masters, or doctoral level, provides the grounding in analytical thinking and the scientific skills necessary to function in today's interdisciplinary environment. The Bachelor of Science degree is a sound preparation for graduate study in mathematics or any of the mathematical sciences, but also for advanced degrees in business administration and some of the quantitative social sciences. A bachelor's degree in mathematics can also provide entry to careers in fields such as management, engineering, banking, insurance, government service, the military, and geology.

An excellent source for information about careers in the mathematical sciences is the Mathematical Association of America (MAA). The pamphlets "Careers in the Mathematical Sciences" and "More Careers in the Mathematical Sciences" provide an indication of the variety of careers available to persons with interest and preparation in the mathematical sciences. Copies may be obtained from the Department of Mathematics Undergraduate Office in LeConte College 413. The following websites are excellent sources of career information in mathematics, applied mathematics and actuarial science:

[www.maa.org/students/career.html](http://www.maa.org/students/career.html)  
[www.ams.org/careers/home.html](http://www.ams.org/careers/home.html)  
[www.beanactuary.com](http://www.beanactuary.com)  
[www.siam.org/careers/](http://www.siam.org/careers/)

The following is a partial list of employers who were recruiting math majors on campus during recent years:

<a href="#">Accenture</a>	<a href="#">Microsoft Corporation</a>	<a href="#">United States Air Force</a>
<a href="#">AT&amp;T</a>	<a href="#">National Security Agency</a>	<a href="#">United States Bureau of Labor Statistics</a>
<a href="#">Blue Cross/Blue Shield of South Carolina</a>	<a href="#">Naval Air Systems Command</a>	<a href="#">United States Bureau of the Census</a>
<a href="#">Central Intelligence Agency</a>	<a href="#">Naval Surface Weapons Center</a>	<a href="#">United States Coast Guard</a>
<a href="#">Colonial Life</a>	<a href="#">National Cash Register (NCR)</a>	<a href="#">United States Department of Energy</a>
<a href="#">Computer Services Corporation (CSC)</a>	<a href="#">South Carolina Department of Education</a>	<a href="#">United States General Accounting Office</a>
<a href="#">Computer Task Group</a>	<a href="#">Spring Industries</a>	<a href="#">United States Office of Comptroller of the Currency</a>
<a href="#">Duke Power Company</a>	<a href="#">State Farm Insurance</a>	<a href="#">Westinghouse</a>
<a href="#">Hawkes Learning Systems</a>	<a href="#">Texas Instruments</a>	<a href="#">Xerox</a>

The electronic version of this brochure includes hyperlinks to employment information at many of the above corporations and agencies. The URL is [www.math.sc.edu/undergrad/ugradbrochure.html](http://www.math.sc.edu/undergrad/ugradbrochure.html).

Additional career information can be found on the Careers link on the Mathematics Department's homepage (<http://www.math.sc.edu/careers.html>). The US Department of Labor, Bureau of Labor Statistics, maintains an Occupation Outlook Handbook at <http://www.bls.gov/oco/>. This is an excellent source of general information about almost any career.

Job prospects depend on your educational background and personal interest. Mathematics majors are encouraged to take several courses in a field that uses or is closely related to mathematics. Popular choices include education, statistics, biology or other physical science, business, finance, and computer science. A double major in mathematics and computer science, or mathematics and statistics, is particularly attractive to employers. The actuarial emphasis combines a major in mathematics with a strong background in statistics and risk management (insurance). This program is particularly suited for students interested in becoming an actuary.

## **MATHEMATICS AT USC**

The University of South Carolina is fast evolving into one of the premier mathematics research centers in the Southeast. The distinguished faculty has attracted national and international recognition through the quality of its research program. The Department has particular strengths in mathematical analysis, discrete mathematics, linear algebra, differential geometry, commutative algebra, logic, number theory, topology, and numerical analysis. It is thus uniquely poised to provide undergraduate and graduate students with the broad background in pure and applied mathematics necessary to perform in today's high-tech environment, whether in an industrial, business, governmental, or academic setting. The Department also maintains a strong commitment to excellence in teaching and proudly counts a number of award-winning teachers among its ranks.

Department computing facilities are excellent. In addition to various University mainframe and workstation computers available via the campus network and in numerous satellite PC laboratories, the Department houses a number of computer-equipped classrooms and open computer labs. A large collection of mathematical and statistical software is installed on these computers for use in courses and research.

## ***DEGREE PROGRAMS***

The Department of Mathematics offers the Bachelor of Science degree in Mathematics. The major is completed with 128 semester hours of overall coursework. Mathematics majors may select from one of four emphases:

- **General Mathematics** – Requires 24 semester hours of mathematics courses beyond calculus (comprising the required core of 15 semester hours and nine semester hours of mathematics electives).
- **Mathematics Education** – Leads to a bachelor's degree in mathematics, with a 12-semester hour education component. Certification is obtained upon completion of the Master of Teaching degree program in Secondary Education. In addition to the core courses, the program requires courses in number theory and geometry and one mathematics elective.
- **Applied Mathematics** – Offers specialization in applied or computational mathematics. A one-semester hour computational lab is added to the 15-semester hour core and nine hours of mathematics electives required in such disciplines as numerical analysis, optimization, and partial differential equations. Applied mathematics majors are encouraged to select a cognate, minor, or second major in computer science, statistics, one of the physical sciences, or engineering.
- **Actuarial Mathematics** – Offers a program of study designed to prepare students for the actuarial profession in the insurance and financial securities industries. In addition to the required mathematics courses, this track requires a minimum of 24 credit hours in Business Administration and Statistics. Depending on the specific collection of courses selected, a cognate and/or minor can be obtained in Statistics and/or Risk Management and Insurance.

The **B.S. in Mathematics with Distinction** is awarded to students who complete an additional 12 semester hours of upper-division mathematics courses approved by the Undergraduate Director, an undergraduate research experience, and an undergraduate thesis.

In addition to the major requirements, each student is required to complete a minor (18 hours of courses related to a common topic) or a cognate (12 hours of integrated courses from a single department) in a discipline related to, but distinct from the major. Note that the Actuarial and Education emphases automatically include a cognate and/or minor.

The department also offers a five-year program of study leading to a Bachelor of Science degree and a Master of Science degree in Mathematics. The program is designated to permit an outstanding student to obtain both a bachelor's degree and a master's degree in mathematics in five years. Students interested in pursuing this option should contact the Graduate Director during the first two years of undergraduate studies.

## ***ADVISING***

When you enroll as mathematics major, the Director of Undergraduate Studies will initially advise you. You will have a Lower-Level Advisor until you have completed calculus (Math 241). An Upper-Level Advisor will be assigned to you as you begin to take upper division mathematics courses. Your advisor will assist in formulating your program of study and preparing you for the beginning of your career (or further education). While the advisor's role is to provide guidance, the student has final responsibility for staying fully informed on University deadlines and relevant academic policies.

It is essential that you meet with your advisor each semester so that you can plan your course of studies for the following semester. The advisement process must be completed before the student can register for the next semester. Most advisement appointments are made through the Undergraduate Office (LeConte 413). You should receive an e-mail from the Undergraduate Director or Program Administrator concerning advisement procedure. If you have not been notified by mid-semester, please see the Undergraduate Program Administrator. *To increase your likelihood of getting the courses you want and need, please be certain to be advised during the regular advisement period.*

Problems do arise, of course, and we encourage you to discuss them with your advisor at any time, whether they are academic or personal in nature. When you have a special problem that is beyond your advisor's authority (such as variations on requirements or special cognates), or when your advisor is not available and you need assistance, contact the Undergraduate Program Administrator in LeConte 413 to set up an appointment with the Director of Undergraduate Studies.

A *Senior Records Check* needs to be completed one year before you plan to graduate. When you have earned approximately 95 credit hours, ask your advisor to complete a *Major Program Card*. This involves listing all major and cognate/minor courses that you intend to take to fulfill the degree requirements. When this has been completed, call the Assistant Dean's Office (777-2505) to request a *Senior Records Check*. The purpose of this check is to identify all unfulfilled graduation requirements while you still have time to complete them without delaying your graduation.

## **AWARDS AND SCHOLARSHIPS**

The Department of Mathematics and College of Arts and Sciences recognize continuing and graduating students at the end of each academic year. The current list of awards and scholarships, with brief descriptions, is shown below. The Undergraduate Advisory Council solicits applications from interested students each spring; the awards are announced and presented at Undergraduate Awards Day.

### **Outstanding Undergraduate Student in Mathematics Education**

*... presented yearly to an outstanding undergraduate student in mathematics education who has exhibited excellence in the mathematics program.*

### **Outstanding Undergraduate Student in Mathematics**

*... presented yearly to an outstanding undergraduate student who has exhibited excellence in the mathematics program.*

### **College of Arts and Sciences Rising Senior Award**

*... awarded annually by the College of Arts and Sciences to a rising senior mathematics major who has demonstrated excellence in mathematics and has a cumulative GPA of at least 3.50.*

### **James Bruce Coleman Mathematics Scholarship**

*... awarded annually by the Department of Mathematics to an outstanding mathematics major from South Carolina. The scholarship was established in 1992 by Joseph Harold Burckhalter (Class of 1934), in memory of the late James Bruce Coleman, who was a professor of mathematics and head of the department from 1915—1942.*

### **Thomas Markham Mathematics Scholarship**

*... awarded annually to an outstanding mathematics major who also has significant extracurricular mathematical activities. The scholarship was established in 1999 in honor of Professor Emeritus Thomas Markham, who was a professor of mathematics from 1968—1999 and undergraduate director 1996—1999.*

### **Polston Family Mathematics Scholarship**

*... is awarded to undergraduate mathematics students who are excelling in the mathematics program. The Polston family established the scholarship in 2008.*

### **Cary K. Smith, Jr., Mathematics Scholarship**

*... awarded annually by the Department of Mathematics to an outstanding undergraduate mathematics major who has demonstrated excellence in mathematics and leadership. The scholarship was established in 1998 in memory of Cary Kincaid Smith, Jr., an Honors graduate of USC who died while performing his duties as a pilot in the U.S. Marine Corps*

### **Wyman L. Williams Scholarship**

*... awarded to an undergraduate mathematics major at the University of South Carolina. Can be renewed for not more than 3 additional years of undergraduate study. Wyman L. Williams came to the University in 1919 as a freshman, joined the Mathematics Department faculty in 1924 and retired in 1970 as Distinguished Professor Emeritus. The Wyman L. Williams Mathematics Scholarship Fund was established in 1975.*

### **Jeong S. Yang Award for Excellence in Undergraduate Mathematics**

*... awarded yearly to outstanding undergraduate mathematics majors at the University of South Carolina selected from students who have earned at least 100 credit hours and have completed at least 4 of the 5 core mathematics courses required for the major with a GPA of at least 3.70 in all upper-division mathematics courses. The award was established by the Department of Mathematics in memory of the late Professor Jeong S. Yang, undergraduate director 1984—1995.*

### **Pi Mu Epsilon Award**

*... presented annually to an outstanding member of Pi Mu Epsilon based on performance in mathematics courses and service to the department. The Undergraduate Advisory Council, in conjunction with the Pi Mu Epsilon advisor, selects the recipient.*

### **Victor W. Laurie Undergraduate Research Scholarship**

*... provides monetary support for an undergraduate student interested in being involved with mathematical research during the summer. This is a competitive award based on proposals submitted by all interested students.*

# MATHEMATICS FACULTY

## PROFESSORS

**Colin Bennett, Ph.D.**,  
University of Newcastle upon Tyne, 1971

**Stephen J. Dilworth, Ph.D.**,  
Cambridge University, 1985

**Michael A. Filaseta, Ph.D.**,  
University of Illinois, 1984

**Maria Girardi, Ph.D.**,  
University of Illinois, 1990

**Jerrold R. Griggs, Ph.D.**,  
*Chair*,  
Massachusetts Institute of Technology, 1977

**Ralph E. Howard, Ph.D.**,  
California Institute of Technology, 1982

**Andrew Kustin, Ph.D.**,  
University of Illinois, 1979

**George F. McNulty, Ph.D.**,  
University of California, Berkeley, 1972

**Matthew Miller, Ph.D.**,  
University of Illinois, 1979,

**Peter J. Nyikos, Ph.D.**,  
Carnegie-Mellon University, 1971

**Pencho Petrushev, Ph.D.**,  
University of Sofia, 1977

**Anton R. Schep, Ph.D.**,  
*Assistant Chair*,  
University of Leiden, 1977

**László A. Székely, Ph.D.**,  
Eötvös University, 1983

**Vladimir Temlyakov, Ph.D.**,  
*Carolina Distinguished Professor*  
Steklov Institute, 1981

**Hong Wang, Ph.D.**,  
University of Wyoming, 1992

**Qi Wang, Ph.D.**,  
Ohio State University, 1991

## ASSOCIATE PROFESSORS

**George Androulakis, Ph.D.**,  
University of Texas, 1996

**Peter G. Binev, Ph.D.**,  
University of Sofia, 1985

**Matthew Boylan, Ph.D.**,  
University of Wisconsin at Madison, 2002

**Joshua N. Cooper, Ph.D.**,  
University of California, San Diego, 2003

**Daniel B. Dix, Ph.D.**,  
University of Chicago, 1988

**Lili Ju, Ph.D.**,  
Iowa State University, 2002

**Linyuan (Lincoln) Lu,**  
Ph.D., University of California, San Diego, 2002

**Douglas B. Meade, Ph.D.**,  
*Undergraduate Director*,  
Carnegie-Mellon University, 1989

**Ognian T. Trifonov, Ph.D.**,  
*Graduate Director*  
University of Sofia, 1990

**Adela Vraciu, Ph.D.**,  
University of Michigan, 2000

**Xian Wu, Ph.D.**,  
Harvard University, 1986

## ASSISTANT PROFESSORS

**Dmitriy Bilyk Ph.D.**,  
University of Missouri, 2005

**Eva Czabarka, Ph.D.**,  
University of South Carolina, 1998

**Xinfeng Liu, Ph.D.**,  
State University of New York, 2006

**Yi Sun, Ph.D.**,  
Princeton University, 2006

**Frank Thorne, Ph.D.**,  
University of Wisconsin at Madison, 2008

**Xiaofeng Yang, Ph.D.**,  
Purdue University 2007

## CLINICAL ASSOCIATE PROFESSOR

**Debra Geddings, Ph.D.**,  
University of South Carolina, 2004

## SENIOR INSTRUCTOR

**Ronda Sanders, M.S.**,  
University of South Carolina, 2004

## INSTRUCTORS

**Courtney Baber, M.S.**,  
Virginia Tech, 2009

**Ivan Haynes, M.S.**,  
University of South Carolina, 2008

## VISITING ASSISTANT PROFESSOR

**Kevin Milans, Ph.D.**,  
University of Illinois, 2010

## RESEARCH ASSOCIATE PROFESSOR

**Borislav Karaivanov, Ph.D.**,  
University of South Carolina, 2001

## ADJUNCT FACULTY

**Edwin M. Dickey, Professor, Ph.D.**,  
University of South Carolina, 1982

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## DISTINGUISHED PROFESSORS EMERITI

**Ronald A. DeVore, Ph.D.**,  
*Robert L. Sumwalt Distinguished Professor Emeritus*  
Ohio State University, 1967

**Thomas L. Markham, Ph.D.**,  
Auburn University, 1967

**James W. Roberts, Ph.D.**,  
Rutgers University, 1970

**H. Edward Scheiblich, Ph.D.**,  
University of Texas, 1966

**Robert M. Stephenson Jr., Ph.D.**,  
Tulane University, 1967

**Robert C. Sharpley, Ph.D.**,  
University of Texas, 1972

**Manfred Stoll, Ph.D.**,  
Pennsylvania State University, 1971

**David P. Sumner, Ph.D.**,  
University of Massachusetts, 1971

## FACULTY EMERITI

**Peter W. Harley III, Ph.D.**,  
University of Georgia, 1966

**Richard H. Hudson, Ph.D.**,  
Duke University, 1971

**George W. Johnson III, Ph.D.**,  
University of Tennessee, 1971

**Karl H. Matthies**,  
Dr. Rerum Naturalium,  
University of Freiburg, 1956

**Charles A. Nicol Jr., Ph.D.**,  
University of Texas, 1954

**Mary Ellen O'Leary, M.A.**,  
University of Michigan, 1967

**Konstantin Oskolkov, Ph.D.**,  
Steklov Institute, 1978

**Paul L. Sperry, Ph.D.**,

# **THE PROGRAM IN MATHEMATICS**

## **DEGREE REQUIREMENTS (128 hours)**

### **1. General Education (44 – 53 hours)**

The general education requirements are designed to prevent students from adopting too narrow an academic focus early in their studies and to provide a broad base from which to select a major area of study consistent with their interests and aptitudes. In addition, these general education courses also serve to develop the learning skills necessary for success in other academic courses.

NOTE: Independent Study courses (such as 399) may not be used to fulfill General Education requirements.

#### **Group I: Competency Group**

The student must pass ENGL 101 and 102 with a grade of C or better, two 100-level history courses and satisfy the Foreign Language requirement. The Group I Foreign Language requirement is a level of proficiency requirement. Students may exempt any part of these requirements by advanced placement.

- a. English 101, 102 - All entering freshmen are placed into English 101. During the first week of class in ENGL 101 diagnostic essays will be written to determine the student's need for special development of writing skills. **(6 credits)**
- b. Foreign Language - Demonstration of proficiency in one foreign language, equivalent to the minimum passing grade on the exit examination in the 122 course, is required for all baccalaureate degrees. Students who have studied French, German, Latin, or Spanish in high school must take the appropriate language placement examination before enrolling in courses in that language. **(0-9 credits)**
- c. Two 100-level history courses - At least one history course must be non-United States History. **(6 credits)**

#### **Group II: Quantitative Group**

The Group II requirements are satisfied by the CSCE and STAT courses that are required as part of the BS in Mathematics.

#### **Group III: Humanities Group**

Each student must pass at least **6** additional hours of study in the humanities; at least one course must be in fine arts.

- a. Courses from the following departments and degree programs may be taken for Group III credit:

##### **Humanities (0-3)**

Afro American Studies  
Classical Studies (230 only)  
English (courses numbered 280 or higher except ENGL 450, 460-463)  
Foreign Languages (courses numbered 201 or higher)  
History (courses numbered 201 or higher)  
Philosophy (all except 110, 111, 511)  
Religious Studies  
Southern Studies (SOST) (298, 299, 301, 302 pending content, 305, 405 pending content)  
Women's Studies (WGST 111 only)

##### **Fine Arts (3-6)**

A fine arts course is defined as a course or courses dealing with the study and/or practice of the visual and performing arts. Students may take courses in art studio, art design, art history and appreciation, film, media arts, music history and appreciation, music theory and performance, theatre history and appreciation, acting, stagecraft, theatre design, and dance to fulfill this requirement.

ARTE  
ARTH  
ARTS  
FILM  
DANC 101 only  
MUSC 110, 112, 115, 140, 215, 316, 320  
THEA

- b. Artistic Skill courses cannot be used for Group III credits. In addition, theatre production laboratories (THEA 119, 120, 212, 123, 219, 220, 221) one-hour credits for participation in music organizations (band, chorus, orchestra), and MART 302 do not apply to the fine arts requirement or to the humanities requirement.

## **Group IV: Social Sciences**

Each student must pass at least **6** additional hours of study in the social and behavioral sciences.

Courses from the following departments and degree programs can be taken for Group IV credit:

ANTH  
CRJU  
ECON  
GEOG  
POLI  
PSYC (all except PSYC 227, 594-599)  
SOCY (all except SOCY 220)  
Southern Studies (SOST) (298, 299, 301, 302 pending content, 305, 405 pending content)  
WGST (112 only)

## **Group V: Laboratory Science**

Each student must pass at least **two 4-credit hour** laboratory science courses.

- a. Students should earn their Group V credits from the following introductory courses:  
ASTR 111, 111A, 211, 211A  
BIOL 101, 102 (biology and pre-med majors only)  
CHEM 111, 112 (grade of “C” or better in 111 before taking 112)  
ENVR 200  
GEOG 101, 102, 103, 105  
PHYS 201, 201L, 202, 202L; or 211, 211L, 212, 212L (grade of “C” or better in 201, 211 before taking 202, 212)  
MSCI 210, 210L, 215, 215L
- b. The following courses are also acceptable for Group V credit:  
BIOL 110, 200, 200L, 270, 270L, 243, 243L, 244, 244L - Acceptable for non-Biology majors only  
CHEM 102 - Acceptable for Mathematics and Statistics majors only.  
CHEM 105, 105L, 106, and 106L – Acceptable for Mathematics and Statistics majors only.  
PHYS 151, 151L, 153, 153L, 155, 155L – Not acceptable for physics majors.

## **2. Pre-Major requirements**

*The following pre-major courses may fulfill some of the General Education requirements.*

- a) MATH 141, 142, and 241 each with a grade of **C** or better (in at most two attempts).
- b) CSCE 145 for Group II.
- c) One of the following sequences:
  1. STAT 511 (or MATH 511) and STAT 512
  2. Either STAT 509 or STAT 515 and either STAT 516 or CSCE 146

**Notes:** *Students who receive a C or lower in either of MATH 141, 142, 241, or their first 500-level MATH course are encouraged to take MATH 300 prior to taking additional core mathematics courses.*

## **3. Major Requirements**

### **RETENTION**

*A grade of C or better is required in each major course and in each of MATH 141, 142, and 241. A student may enroll in each major course and in each of MATH 141, 142, 241 a maximum of two times. (**Enrolled in a course is interpreted to mean that a grade, including W, has been recorded**). A student may repeat a maximum of three mathematics courses (receiving a grade of **W** is not considered a repeat).*

Students who violate the retention policy can file a petition in the Dean’s Office requesting an exception to this policy. Otherwise, the student will have to find a new major.

## **PROGRAM OPTIONS**

There are five program options offered in Mathematics, each leading to a Bachelor of Science degree.

**Note:** Only one of MATH 526 and 544 may be applied toward major credit.

### ▪ ***General Mathematics Emphasis (24-25 hrs)***

- a) Core: MATH 520, 526 or 544, 546, 554, 574
- b) Flexible Major Elective: At least one course selected from MATH 534, 550, 552
- c) Major Electives: 6 hours in MATH numbered above 500, selected in consultation with the advisor

### ▪ ***Math Education Emphasis (24 – 25 hrs)***

- a) MATH 544 (or 526), 546, 554, 574
- b) MATH 580 and either MATH 531 or 532
- c) Six (6) hours chosen from MATH 511, 520, 531, 532, 550, 552
- d) For the cognate, students must take EDFN 300, EDTE 400 (1 hr), EDPY 401 and 401P (1 hr), and EDTE 402, 402P (1 hr)

### ▪ ***Actuarial Mathematics Emphasis (55 hrs)***

- a) At least 24 hours of Mathematics courses
  - i) MATH 520, 526 (or 544), 546, 554, 574
  - ii) MATH 511 and either MATH 570 or 524
  - iii) Three (3) hours in MATH at the 500 level
- b) A minimum of 24 hours in Business Administration and Statistics as follows.
  - i) Statistics (6 – 12 hours): STAT 512, 513 and 0 – 6 hours from STAT 510, 520 (=MGSC 520)
  - ii) Business Administration (12 – 18 hours): ACCT 222, ECON 224, FINA 363 (=ECON 363), FINA 341 or 444, and 0 – 6 hours from FINA 364, 442, 443, 444, 445, MGSC 392, 393, 520 (=STAT 520), 594 ECON 420, 594, BADM 499. For the Minor in Risk Management & Insurance (18 hours), of the additional 6 hours, an additional three hours must be chosen from FINA 442, 443, 444, or 445.
- c) At least two computing courses:
  - i) CSCE 145 and
  - ii) One of CSCE 146, MGSC 390, or STAT 517

**Note:** The Actuarial Emphasis includes a cognate and/or minor in Statistics and/or Risk Management and Insurance.

### ▪ ***Applied Mathematics Emphasis (25 hrs)***

- a) MATH 520, 526 (recommended) or 544, 546, 554, and 574
- b) Three additional courses chosen from the following five categories:
  - i) Differential Equations and Modeling:  
MATH 521, 522, 523
  - ii) Discrete Mathematics: MATH 570, 575, 587 (=CSCE 557), 541, and 576
  - iii) Financial Mathematics and Probability  
MATH 511 (=STAT 511), 514, 515
  - iv) Optimization and Computation:  
MATH 524, 527, 570
  - v) Analysis: MATH 550, 552

**Note:** Two courses must be chosen from one category and the third must be chosen from a different category.

### ▪ ***B.S. with Distinction***

Available to students majoring in mathematics who wish to participate in significant research with a faculty mentor.

#### *Prerequisite*

A minimum GPA of 3.60 in upper division (500 and above) major courses and 3.30 overall when the student applies to enter the departmental undergraduate research track.

#### *Requirements*

The student should apply to enter the departmental undergraduate research track and choose the members of the thesis committee as early as possible, but in all cases at least one year before submitting and defending the thesis. The thesis committee will consist of a thesis advisor, who must be a tenure-track faculty member in mathematics, and one or two other tenure-track or research faculty members in Mathematics or any other department, as approved by the Undergraduate Advisory Council. The senior thesis will produce a piece of original research and a public presentation of the research in a venue approved by the research advisor. The student may use their senior thesis to simultaneously fulfill other requirements as well (e.g., Magellan Scholarship, Honors College Thesis, etc.), at the discretion of the thesis advisor.

By the end of the semester in which the student is admitted into the research track, a brief research plan must be agreed upon by the thesis committee and the student, and filed in the Department of Mathematics and College of Arts and Sciences. Before submitting and defending the thesis, the student must have completed three credit hours of MATH 499 (Undergraduate Research) under the supervision of the thesis advisor, and at least 12 hours of upper-level (500 and above) mathematics credit beyond their major requirements approved by the Undergraduate Director.

Students who successfully fulfill all of these requirements with a GPA of at least 3.60 in upper division (500 and above) major courses and 3.30 overall, will be awarded their degree with "Distinction in Mathematics" upon graduation.

## **4. Cognates, Minors, Double Majors and Dual Degrees**

### **MINORS**

You may replace the cognate with a minor if you so desire. The minor consists of eighteen hours of coursework instead of the twelve needed for the cognate. The minor is also more structured. All courses in the minor must be passed with grades of C or better. Students who are planning to minor in a subject area need to go to the Dean's office and fill out the appropriate forms to declare the minor. Otherwise, the minor will not show up on the transcript.

Four minors that are popular with mathematics majors are as follows:

- **MINOR IN COMPUTER SCIENCE**

1. Required Courses: CSCE 145, 146, 212; and one of CSCE 211 and 245
2. Advanced Courses: Any two CSCE courses at the 300 level or above with the exception of CSCE 500. Recommended tracks are listed on the CSCE website at <http://www.cse.sc.edu/acadinfo/CSMinor.html>. Note that some CSCE courses have MATH or STAT prerequisites.

- **MINOR IN RISK MANAGEMENT AND INSURANCE**

1. Required Courses: ACCT 222, ECON 224, FINA 363[=ECON 363], plus
  - a) FINA 341 or 444,
  - b) 3 credit hours chosen from FINA 342, 442, 443, 444, or 445,
  - c) 3 credit hours chosen from FINA 342, 364, 442, 443, 444, 445, MGSC 392, 393, 520 [=STAT 520], 594, ECON 420, 594, or BADM 499.

- **MINOR IN EDUCATION**

1. EDFN 300, EDTE 400, EDPY 401 and 401P, and EDTE 402 and 402P plus six credits chosen from your area of specialization.

- **MINOR IN STATISTICS**

1. Required Courses: Six 500-level STAT courses approved by the Undergraduate Director of Statistics. Only one of STAT 509 and STAT 515 may be counted for minor credit.

## COGNATES

The cognate consists of 12 hours of upper-division courses selected in consultation with, and approved by, your advisor. Mathematics majors may satisfy this requirement by passing 12 credit hours of cognate eligible courses offered by the College of Arts and Sciences or Department of Computer Science and Engineering. Cognates selected from other disciplines should be supportive\* of the major and must be in one field selected with and approved by the student's academic advisor. The Undergraduate Director must approve all exceptions in advance.

- *If a discipline is not supportive of the major, then the student should pursue a minor in that subject area.*

Here is a partial list of cognate-eligible courses:

<b>Accounting (ACCT):</b> All numbered 403 and above	<b>History (HIST):</b> All numbered 300 and above
<b>Aeronautics (AERO):</b> 301, 302, 401, 402	<b>International Business (IBUS)</b> All numbered 401 and above
<b>Anthropology (ANTH)</b> All except 101 and 102	<b>Journalism (JOUR)</b> All numbered 300 and above except 310
<b>Army ROTC (ARMY):</b> All numbered 301 and above	<b>Management (MGMT):</b> All numbered 371 and above
<b>Astronomy (ASTR):</b> All numbered 211 and above	<b>Marine Science (MSCI):</b> All courses numbered 311 and above
<b>Biology (BIOL):</b> All courses numbered 300 through 600 levels	<b>Marketing (MKTG):</b> All numbered 350 and above
<b>Chemistry (CHEM):</b> All except 101, 102, 105, 106, 111, 112, 118	<b>Music (MUSC)</b> All numbered 200 and above except 565 and courses in applied music
<b>Computer Science (CSCE):</b> All numbered 212 and above except 500	<b>Navy (NAVY):</b> All numbered 300 and above
<b>Economics (ECON):</b> All numbered 300 and above	<b>Nursing (NURS):</b> All numbered 300 and above
<b>Education (all designators):</b> EDFN 300, EDTE 400, EDPY 401 and 401P, and EDTE 402 and 402P	<b>Pharmacy (PHAR):</b> All numbered 500 and above
<b>Engineering (all designators):</b> All numbered 200 and above except EECE 200	<b>Philosophy (PHIL):</b> All numbered 200 and above
<b>English (ENGL):</b> All numbered 300 and above except 450, 461, 462, 463, 620	<b>Physics (PHYS):</b> 207, 208 and all numbered 212 and above
<b>Environmental Studies (ENVR):</b> 221 (cross-listed with ENHS)	<b>Political Science (POLD):</b> All numbered 300 and above
<b>Exercise Science (EXSC)</b> All numbered 303 and above except 315, 316	<b>Psychology (PSYC):</b> All numbered 300 and above except 594-599
<b>Finance (FINA):</b> All numbered 311 and above	<b>Religious Studies (RELG):</b> All numbered 300 and above
<b>Foreign Languages (all designators):</b> All numbered 300 and above except 315, 316	<b>Sociology (SOCY):</b> All numbered 300 and above
<b>Geography (GEOG):</b> All numbered 200 and above except 531	<b>Theater (THEA):</b> All numbered 561 and above
<b>Geology (GEOL):</b> All numbered 300 and above	<b>Statistics (STAT):</b> All numbered 500 and above. <i>Only one of STAT 509 and 515 may be used for cognate credit</i>

## Double Majors and Dual Degrees

Instead of selecting a cognate (12 hours) or a minor (18 hours), you may wish to select a double major, which requires an additional 24 hours or more in a second discipline within the College of Arts and Sciences. (The only exception to this is Computer Science, in the College of Engineering and Information Technology. Other combinations of majors involving two colleges are possible only as dual degrees.)

Students interested in other combinations of degrees must pursue dual degrees. This means that students must satisfy all requirements, including General Education requirements, for each degree. The same courses can be applied towards the General Education requirements for each degree; no course may be counted towards the Major Requirements for more than one degree.

Double majors and dual degrees must be approved by the Dean and can be easily accommodated within the 128-hour degree require if the decision is made reasonably early, say in the second year. The double major in Mathematics and Computer Science is particularly attractive to many students.

## 5. Electives

Requirements for the baccalaureate degree in the College of Arts and Sciences include at least 128 hours in academic subjects. Students in the College of Arts and Sciences may elect acceptable courses offered in other colleges of the University. Elective credits for participation in the University chorus, orchestra, or band may be counted up to a maximum of 4 credits.

## 6. Honors Courses

Honors MATH courses are available to highly qualified students regardless of whether they are in the South Carolina Honors College. Non-Honors College students must receive approval from the Undergraduate Director prior to being permitted to register for an honors MATH course.

The calculus courses and most of the core courses in the mathematics degree are regularly offered for honors credit. In addition to multiple sections of the three calculus courses (MATH 141, 142, and 241), special Honors sections of MATH 242 and MATH 550 are available. Honors sections of MATH 544 and MATH 574 are offered once each year. MATH 546 and MATH 554 are offered as Honors sections in fall semesters. Other courses, including MATH 520, 547, 555, and 575, are offered for Honors credit when student interest and staffing permit.

## 7. Five-Year Program

This program of study is designed to permit an outstanding mathematics student to obtain both a bachelor's degree, as described above, and a master's degree in mathematics in five years, while at the same time receiving undergraduate and graduate assistant support during the last two years.

### Guidelines of the program

1. To be considered for the program, the student must have earned at least 103 hours by the start of his senior year, and must have completed one of the preparatory undergraduate sequences MATH 546-547 or MATH 554-555. This is easily accomplished if the student has received undergraduate credit through advanced placement examinations, or enrolls for one or more summer sessions.
2. During their senior year, the student takes, for graduate credit, the basic graduate sequence, MATH 700-701 (or 706) or MATH 703-704 corresponding to the undergraduate sequence they have already taken. In addition, the student will complete the other preparatory undergraduate course sequence. The remaining 9 hours in the fall semester of the senior year will consist of additional undergraduate or graduate courses. This will leave the student 10 hours short of his bachelor's degree, which will be completed in the spring semester.
3. For the spring semester of the senior year, the student is conditionally admitted into the graduate program. Final acceptance into the program will be contingent upon receipt of the bachelor's degree at the end of spring semester. To be considered for admission, except for lacking the bachelor's degree, the student must meet all other requirements for admission to the graduate program.

### Admission into the program

The prospective student will normally be considered for admission into the program during the fall semester of their senior year. A recommendation from their undergraduate advisor is a critical part of the application. It is expected that the prospective student will have attained a 3.5 overall GPA, a 3.5 on all mathematics courses taken, and will have taken the GRE examination by the end of October of their senior year.

By November 1, the prospective student must submit an application with all supporting material to the Graduate School for admission into the M.S. program in Mathematics for the following spring semester. A decision on admission into the graduate program will be made prior to the start of the spring semester. Prior to registration for the fall semester, the student must also secure the required signatures on the "Senior Privilege" form (GS19) available from the Graduate School to register for 700-level courses.

### c) Financial Aid

Upon admission to the program, the student will be eligible for financial assistance from the department as follows: During the fall semester of the senior year, the student will receive consideration for employment as an undergraduate assistant for 10 hours per week, and during the spring semester of the senior year, the student will receive consideration for a quarter-time graduate assistantship. In the fifth year and the first and second summer of graduate study, the student will be eligible for a halftime graduate teaching assistantship.

**Note:** *Students considering the Five-Year Program should discuss their plans with the Graduate Director, in addition to their regular advisor. This discussion should begin as early as possible, typically during the student's sophomore year.*

## DESCRIPTIONS OF UNDERGRADUATE MATHEMATICS COURSES

- 111 Basic College Mathematics. (3)** (Prereq: Placement code MB2 required; earned by Algebra Placement Test) Basic college algebra; linear and quadratic equations, inequalities, functions and graphs of functions, exponential and logarithm functions, systems of equations. Credit may not be received for both MATH 111 and 115.
- 111I Intensive Basic College Mathematics. (4)** (Prereq: Placement code MB1 required; earned by Algebra Placement Test) An intensive treatment of the topics covered in MATH 111.
- 112 Trigonometry. (2)** (Prereq: Placement code MB4-9 required; earned by grade of C or better in MATH 111 or 111I, or Algebra Placement Test) Topics in trigonometry specifically needed for MATH 141, 142, 241. Circular functions, analytic trigonometry, applications of trigonometry. Credit may not be received for both MATH 112 and 115.
- 115 Precalculus Mathematics. (4)** (Prereq: Placement code MA2 or MC0-9; earned by grade of C or better in MATH 111 or 111I, or by Precalculus Placement Test) Topics in algebra and trigonometry specifically needed for MATH 141, 142, 241. Subsets of the real line, absolute value; polynomial, rational, inverse, logarithmic, exponential functions; circular functions; analytic trigonometry. Credit may not be received for both MATH 111 and 115 or both MATH 112 and 115.
- 116 Brief Precalculus Mathematics. (2)** (Prereq: Placement code MA4-9 [or by Departmental Permission] required; earned by grade of C or better in MATH 115 or by Precalculus Placement Test) Essential algebra and trigonometry topics for Calculus, including working with equations that involve polynomials, rational functions, exponential and logarithmic functions, and trigonometric and inverse trigonometric functions. Intended for students with prior experience in Precalculus, but not ready for MATH 141.
- 122 Calculus for Business Administration and Social Sciences. (3)** (Prereq: Placement code MB4-9 required; earned by grade of C or better in MATH 111 or 111I, or by Algebra Placement Test) Derivatives and integrals of elementary algebraic, exponential, and logarithmic functions. Maxima, minima, rate of change, motion, work, area under a curve, and volume.
- 141 Calculus I. (4)** (Prereq: Placement code MA4-9 or MD0-9 required; earned by grade of C or better in Math 112, 115, or 116, or by Precalculus Placement Test.) Four classroom hours and one laboratory hour per week. Functions, limits, derivatives, introduction to integrals, the Fundamental Theorem of Calculus, applications of derivatives and integrals.
- 142 Calculus II. (4)** (Prereq: Qualification through placement or a grade of C or better in MATH 141) Four classroom hours and one laboratory hour per week. Methods of integration, sequences and series, approximations.
- 151 Calculus Workshop I. (2)** (Coreq: MATH 141) Small study group practice in applications of calculus. For elective credit only. Two 2-hour sessions per week.
- 152 Calculus Workshop II. (2)** (Coreq: MATH 142) Small study group practice in applications of calculus. For elective credit only. Two 2-hour sessions per week.
- 170 Finite Mathematics. (3)** (Prereq: Placement code MA4-9, MC0-9 required; earned by grade of C or better in MATH 111/111I, or by Algebra Placement Test) Elementary matrix theory; systems of linear equations; permutations and combinations; probability and Markov chains; linear programming and game theory.
- 172 Mathematical Modeling for the Life Sciences. (3)** (prereq: C or better in MATH 122 or 144) Modeling with difference equations; vectors, trigonometry, polar coordinates, matrices, eigenvalues and eigenvectors; addition and multiplication in combinatorics, permutations, combinations, introduction to probability theory (discrete, continuous); techniques of integration, symmetry. Credit may not be received for both MATH 172 and either MATH 170 or 174.
- 174 Discrete Mathematics for Computer Science. (3)** (Prereq: qualification through placement or a grade of C or better in MATH 112 or 115) Induction, complexity, elementary counting, combinations and permutations, recursion and recurrence relations, graphs and trees; discussion of the design and analysis of algorithms--with emphasis on sorting and searching.
- 198 Introduction to Careers and Research in the Mathematical Sciences. (1)** (Prereq: qualification through placement in MATH 142 or higher, or a grade of C or better in MATH 141) An overview of different areas of mathematical research and career opportunities for Mathematics majors.
- 221 Basic Concepts of Elementary Mathematics I. (3)** (Prereq: Placement code MB4-9 or MD0-9 required; earned by grade of C or better in MATH 111/111I, or by Algebra Placement Test) The meaning of number, fundamental operations of arithmetic, the structure of the real number system and its subsystems, elementary number theory. Open only to students in elementary or early childhood teacher certification.

- 222 Basic Concepts of Elementary Mathematics II. (3)** (Prereq: Grade of C or better in MATH 221, or consent of the instructor) Informal geometry and basic concepts of algebra. Open only to students in elementary or early childhood teacher certification.
- 241 Vector Calculus. (3)** (Prereq: qualification through placement or a grade of C or better in MATH 142) Vector algebra, geometry of three-dimensional space; lines, planes, and curves in space; polar, cylindrical, and spherical coordinate systems; partial differentiation, max-min theory; multiple and iterated integration, line integrals, and Green's theorem in the plane.
- 242 Elementary Differential Equations. (3)** (Prereq: qualification through placement or a grade of C or better in MATH 142) Ordinary differential equations of first order, higher order linear equations, Laplace transform methods, series methods; numerical solution of differential equations. Applications to physical sciences and engineering.
- 300 Transition to Advanced Mathematics. (3)** (Prereq: Grade of C or better in MATH 142) Rigor of mathematical thinking and proof writing via logic, sets, and functions. Intended to bridge the gap between lower-level (computational-based) and upper-level (proof-based) mathematics courses.
- 374 Discrete Structures. (3)** (Prereq: MATH 142 and CSCE 146) Propositional and predicate logic; proof techniques; recursion and recurrence relations; sets, combinatorics, and probability; functions, relations, and matrices; algebraic structures.
- 399 Independent Study. (3-9)** Contract approved by instructor, advisor, and department chair is required for undergraduate students.
- 401 Conceptual History of Mathematics. (3)** (Prereq: MATH 122, or 141, or consent of the department) Topics from the history of mathematics emphasizing the 17th century to the present. Various mathematical concepts are discussed and their development traced. For elective or Group II credit only.
- 499 Undergraduate Research. (1-3)** Research on a specific mathematical subject area. The specific content of the research project must be outlined in a proposal that must be approved by the instructor and the Undergraduate Director. Intended for students pursuing the B.S. in Mathematics with Distinction (Pass-Fail grading only.)
- 511 Probability. {= STAT 511} (3)** (Prereq: a grade of C or higher in either MATH 241) Probability and independence; discrete and continuous random variables; joint, marginal, and conditional densities, moment generating functions; laws of large numbers; binomial, Poisson, gamma, univariate, and bivariate normal distributions.
- 514 Financial Mathematics I. {=STAT 522} (3)** (Prereq: a grade of C or better in either MATH 241) Probability spaces. Random variables. Mean and variance. Geometric Brownian Motion and stock price dynamics. Interest rates and present value analysis. Pricing via arbitrage arguments. Options pricing and the Black-Scholes formula.
- 515 Financial Mathematics II. {=STAT 523} (3)** (Prereq: MATH 514 or STAT 522 with a grade of C or better) Convex sets. Separating Hyperplane Theorem. Fundamental Theorem of Asset Pricing. Risk and expected return. Minimum variance portfolios. Capital Asset Pricing Model. Martingales and options pricing. Optimization models and dynamic programming.
- 520 Ordinary Differential Equations. (3)** (Prereq: MATH 544 or 526; or consent of department) Differential equations of the first order, linear systems of ordinary differential equations, elementary qualitative properties of nonlinear systems.
- 521 Boundary Value Problems and Partial Differential Equations. (3)** (Prereq: MATH 520 or 241 and 242) Laplace transforms, two-point boundary value problems and Green's functions, boundary value problems in partial differential equations, eigenfunction expansions and separation of variables, transform methods for solving PDE's, Green's functions for PDE's, and the method of characteristics.
- 522 Wavelets. (3)** (Prereq: MATH 544 or 526 or consent of department) Basic principles and methods of Fourier transforms, wavelets, and multiresolution analysis; applications to differential equations, data compression, and signal and image processing; development of numerical algorithms. Computer implementation.
- 523 Mathematical Modeling of Population Biology. (3)** (Prereq: MATH 142, BIOL 301, or MSCI 311 recommended) Applications of differential and difference equations and linear algebra modeling the dynamics of populations, with emphasis on stability and oscillation. Critical analysis of current publications with computer simulation of models.
- 524 Nonlinear Optimization. (3)** (Prereq: MATH 526 or 544 or consent of department) Descent methods, conjugate direction methods, and Quasi-Newton algorithms for unconstrained optimization; globally convergent hybrid algorithm; primal, penalty, and barrier methods for constrained optimization. Computer implementation of algorithms.
- 525 Mathematical Game Theory. (3)** (Prereq: MATH 526 or 544) Two-person zero-sum games, minimax theorem, utility theory, n-person games, market games, stability.

- 526 Numerical Linear Algebra. (4)** (Prereq: MATH 241) Matrix algebra, Gauss elimination, iterative methods; overdetermined systems and least squares; eigenvalues, eigenvectors; numerical software. Computer implementation. Three lectures and one laboratory hour per week. Credit may not be received for both MATH 526 and MATH 544.
- 527 Numerical Analysis. {=CSCE 561} (3)** (Prereq: MATH 242 or 520) Interpolation and approximation of functions; solution of algebraic equations; numerical differentiation and integration; numerical solutions of ordinary differential equations and boundary value problems; computer implementation of algorithms.
- 531 Foundations of Geometry. (3)** (Prereq: MATH 241) The study of geometry as a logical system based upon postulates and undefined terms. The fundamental concepts and relations of Euclidean geometry developed rigorously on the basis of a set of postulates. Some topics from non-Euclidean geometry.
- 532 Modern Geometry. (3)** (Prereq: MATH 241) Projective geometry, theorem of Desargues, conics, transformation theory, affine geometry, Euclidean geometry, non-Euclidean geometries, and topology.
- 533 Elementary Geometric Topology. (3)** (Prereq: MATH 241) Topology of the line, plane, and space, Jordan curve theorem, Brouwer fixed point theorem, Euler characteristic of polyhedra, orientable and non-orientable surfaces, classification of surfaces, network topology.
- 534 Elements of General Topology. (3)** (Prereq: MATH 241) Elementary properties of sets, functions, spaces, maps, separation axioms, compactness, completeness, convergence, connectedness, path connectedness, embedding and extension theorems, metric spaces, and compactification.
- 540 Modern Applied Algebra. (3)** (Prereq: MATH 241) Finite structures useful in applied areas. Binary relations, Boolean algebras, applications to optimization, and realization of finite state machines.
- 541 Algebraic Coding Theory. (3)** (Prereq: MATH 526 or MATH 544 or consent of department) Error-correcting codes, polynomial rings, cyclic codes, finite fields, BCH codes.
- 544 Linear Algebra. (3)** (Prereq: MATH 241) Matrix algebra, solution of linear systems; notions of vector space, independence, basis, dimension; linear transformations, change of basis; eigenvalues, eigenvectors, Hermitian matrices, diagonalization; Cayley-Hamilton theorem. Credit may not be received for both MATH 526 and MATH 544.
- 546 Algebraic Structures I. (3)** (Prereq: MATH 241) Permutation groups; abstract groups; introduction to algebraic structures through study of subgroups, quotient groups, homomorphisms, isomorphisms, direct product; decompositions; introduction to rings and fields.
- 547 Algebraic Structures II. (3)** (Prereq: MATH 546) Rings, ideals, polynomial rings, unique factorization domains; structure of finite groups; topics from: fields, field extensions, Euclidean constructions, modules over principal ideal domains (canonical forms).
- 550 Vector Analysis II. (3)** (Prereq: a grade of C or higher in either MATH 241) Vector fields, line and path integrals, orientation and parametrization of lines and surfaces, change of variables and Jacobians, oriented surface integrals, theorems of Green, Gauss, and Stokes; introduction to tensor analysis.
- 551 Introduction to Differential Geometry. (3)** (Prereq: MATH 241) Parametrized curves, regular curves and surfaces, change of parameters, tangent planes, the differential of a map, the Gauss map, first and second fundamental forms, vector fields, geodesics, and the exponential map.
- 552 Applied Complex Variables. (3)** (Prereq: MATH 241) Complex integration, calculus of residues, conformal mapping, Taylor and Laurent Series expansions, applications.
- 554 Analysis I. (3)** (Prereq: MATH 241) Least upper bound axiom, the real numbers, compactness, sequences, continuity, uniform continuity, differentiation, Riemann integral and fundamental theorem of calculus.
- 555 Analysis II. (3)** (Prereq: MATH 554 or consent of department) Riemann-Stieltjes integral, infinite series, sequences and series of functions, uniform convergence, Weierstrass approximation theorem, selected topics from Fourier series or Lebesgue integration.
- 561 Introduction to Mathematical Logic. (3)** (Prereq: MATH 241) Syntax and semantics of formal languages; sentential logic, proofs in first order logic; Godel's completeness theorem; compactness theorem and applications; cardinals and ordinals; the Lowenheim-Skolem-Tarski theorem; Beth's definability theorem; effectively computable functions; Godel's incompleteness theorem; undecidable theories.
- 562 Theory of Computation. {=CSCE 551} (3)** (Prereq: CSCE 350 or MATH 526 or 544 or 574) Basic theoretical principles of computer science as modeled by formal languages and automata; computability and computational complexity. Major credit may not be received for both CSCE 355 and CSCE 551.

- 570 Discrete Optimization. (3)** (Prereq: MATH 526 or 544) Discrete mathematical models. Applications to such problems as resource allocation and transportation. Topics include linear programming, integer programming, network analysis, and dynamic programming.
- 574 Discrete Mathematics I. (3)** (Prereq: MATH 142) Mathematical models; mathematical reasoning; enumeration; induction and recursion; tree structures; networks and graphs; analysis of algorithms.
- 575 Discrete Mathematics II. (3)** (Prereq: MATH 574) A continuation of MATH 574. Inversion formulas; Polya counting; combinatorial designs; minimax theorems; probabilistic methods; Ramsey theory; other topics.
- 576 Combinatorial Game Theory. (3)** (Prereq: MATH 526, 544, or 574) Winning in certain combinatorial games such as Nim, Hackenbush, and Domineering. Equalities and inequalities among games, Sprague-Grundy theory of impartial games, games which are numbers.
- 580 Elementary Number Theory. (3)** (Prereq: MATH 241) Divisibility, primes, congruences, quadratic residues, numerical functions. Diophantine equations.
- 587 Introduction to Cryptography. {=CSCE 557} (3)** (Prereq: CSCE 145, MATH 241, and either CSCE 355 or MATH 574) Design of secret codes for secure communication, including encryption and integrity verification: ciphers, cryptographic hashing, and public key cryptosystems such as RSA. Mathematical principles underlying encryption. Code-breaking techniques. Cryptographic protocols.
- 590 Undergraduate Seminar. (1-3)** (Prereq: consent of instructor) A review of literature in specific subject areas involving student presentations. Content varies and will be announced in the *Master Schedule of Classes* by suffix and title. Pass-fail grading. For undergraduate credit only.
- 599 Topics in Mathematics. (1-3)** Recent developments in pure and applied mathematics selected to meet current faculty and student interest.
- 602 An Inductive Approach to Geometry. (3)** (Prereq: MATH 122 or 141) This course is designed for middle level pre-service mathematics teachers. This course covers geometric reasoning, Euclidean geometry, congruence, area, volume, similarity, symmetry, vectors, and transformations. Dynamic software will be utilized to explore geometric concepts. This course cannot be used towards a major in mathematics.
- 603 Inquiry Approach to Algebra. (3)** (Prereq: A grade of C or higher in MATH 122 or MATH 141 or equivalent) This course introduces basic concepts in number theory and modern algebra that provide the foundation for middle level arithmetic and algebra. Topics include: algebraic reasoning, patterns, inductive reasoning, deductive reasoning, arithmetic and algebra of integers, algebraic systems, algebraic modeling, and axiomatic mathematics. This course cannot be used for credit towards a major in mathematics.
- 650 Calculus for Teachers (3)** (Prereq: current secondary high school teacher certification in mathematics and at least 6 hours of calculus) A thorough study of the topics to be presented in AP calculus, including limits of functions, differentiation, integration, infinite series, and applications. (Not intended for degree programs in mathematics.)

# PLANNING YOUR DEGREE PROGRAM

A general schedule for the offering of upper-division mathematics courses is shown below. A collection of sample programs of study and a graduation checklist are also included in this document. Additional programs of study, including a blank form for you to use to plan and monitor your personal progress can be found under the [Undergraduate Program](http://www.math.sc.edu/) link on the Department of Mathematics homepage (<http://www.math.sc.edu/>).

## Tentative Schedule of Regularly-Offered Upper-Division Courses

Course	Name	Fall 2011	Spring 2012	Summer 2012 (I or II)	Fall 2012	Spring 2013	Summer 2013 (I or II)
300	Transition to Advanced Math	√			√		
374	Discrete Structures	√	√		√	√	
401	Conceptual History of Math					√	
511	Probability	√	√	√	√	√	√
514	Financial Math I	√			√		
515	Financial Math II					√	
520	Ordinary Differential Eqns	√	√	√	√	√	√
521	BVP & PDE					√	
522	Wavelets				√		
523	Math Model of Population Biol	√					
524	Nonlinear Optimization				√		
525	Mathematical Game Theory						
526	Numerical Linear Algebra	√	√		√	√	
527	Numerical Analysis		√				
531	Foundations of Geometry	√			√		
532	Modern Geometry		√			√	
533	Geometric Topology						
534	General Topology				√		
540	Modern Applied Algebra						
541	Algebraic Coding Theory						
544	Linear Algebra	√	√+H	√	√	√+H	√
546	Algebraic Structures I	√+H	√	√	H	√	√
547	Algebraic Structures II		H			H	
550	Vector Analysis II	√	√+H	√	√	√+H	√
551	Differential Geometry	√					
552	Applied Complex Variables		√			√	
554	Analysis I	H	√	√	√+H	√	√
555	Analysis II		H			√	
561	Mathematical Logic						
562	Theory of Computation						
570	Discrete Optimization	√					
574	Discrete Mathematics I	√+H	√	√	√+H	√	√
575	Discrete Mathematics II					H	
576	Combinatorial Game Theory						
580	Elementary Number Theory	√		√	√		√
587	Cryptography						

Key: √ - Regular section offered, H - Honors section offered, √+H – Separate regular and Honors sections offered

*Whether a course actually runs is entirely dependent upon enrollment and staffing.*

**Sample Program of Study for the General Emphasis  
(without 300)**

**B. S. in Mathematics**

Cognate/Minor: \_\_\_\_\_

	Fall Semester	Hrs	Spring Semester	Hrs	Total Hrs
Freshman	MATH 141	4	MATH 142	4	
	ENGL 101	3	ENGL 102	3	
	Group V	4	Group V	4	
	HIST 1xx	3	HIST 1yy	3	
	Group IV (or Univ 101)	3	Group IV (or Group III)	3	
	Semester Total	17	17		<u>34</u>
					34
Sophomore	MATH 241	3	MATH 544 (or 526)	3	
	MATH 574	3	MATH 552, 550, or 534	3	
	CSCE 145	4	Group III	3	
	Group III (or Group IV)	3	Group IV (or Elective)	3	
	Elective	3	Cognate/Minor	3	
	Semester Total	16	15		<u>31</u>
					65
Junior	MATH 520	3	MATH 554 or 546	3	
	MATH 5xx	3	MATH 5yy	3	
	STAT 509, 511, or 515	3	STAT 512 or 516	3	
	LANG 121	4	LANG 122	3	
	Cognate/Minor	3	Cognate/Minor	3	
	Semester Total	16	15		<u>31</u>
					96
Senior	MATH Elective	3	MATH 546 or 554	3	
	Cognate/Minor	3	Minor/Elective	3	
	Minor/Elective	3	Elective	3	
	Elective	3	Elective	3	
	Elective	3	Elective	3	
	Elective	3			
	Semester Total	18	15		<u>33</u>
				Total	129

## Sample Program of Study for the Education Emphasis

### B. S. in Mathematics

Cognate/Minor: Education

	Fall Semester	Hrs	Spring Semester	Hrs	Total Hrs
Freshman	MATH 141	4	MATH 142	4	
	ENGL 101	3	ENGL 102	3	
	Group V	4	Group V	4	
	HIST 1xx	3	HIST 1yy	3	
	Group IV (or Univ 101)	3	Group IV (or Group III)	3	
	Semester Total	17	17		34
					34
Sophomore	MATH 241	3	MATH 544 (or 526)	3	
	MATH 574 (or 300)	3	STAT 516	3	
	STAT 509 or 515	3	CSCE 145 (or 574)	4	
	Group III (or IV)	3	Elective (or Group IV)	3	
	EDFN 300	3	Elective	3	
	EDTE 400	1			
	Semester Total	16	16		32
					66
Junior	MATH 520	3	MATH 554 or 546	3	
	MATH 531 (or 580)	3	Group III	3	
	LANG 121	4	LANG 122	3	
	EDPY 401	3	EDTE 402	3	
	EDPY 401P	1	EDTE 402P	1	
	Elective	3	Elective	3	
	Semester Total	17	16		33
					99
Senior	MATH 580 (or 531)	3	MATH 546 or 554	3	
	MATH Elective	3	MATH 532 (or 550/552)	3	
	Minor/Elective	3	Minor/Elective	3	
	Minor/Elective	3	Minor/Elective	3	
	Elective (or CSCE 145)	3	Elective	3	
	Semester Total	15	15		30
				Total	129

**Sample Program of Study for the Applied Emphasis  
(without 300)**

**B. S. in Mathematics**

Cognate/Minor: \_\_\_\_\_

	Fall Semester		Spring Semester		Total Hrs
		Hrs		Hrs	
Freshman	MATH 141	4	MATH 142	4	
	ENGL 101	3	ENGL 102	3	
	Group V	4	Group V	4	
	HIST 1xx	3	CSCE 145	4	
	Group IV (or Univ 101)	3			
	<b>Semester Total</b>	<b>17</b>		<b>15</b>	<b><u>32</u></b>
					<b>32</b>
Sophomore	MATH 241	3	MATH 526	4	
	MATH 574	3	MATH 511 (or 554/546)	3	
	CSCE 146	4	HIST 1yy	3	
	Group III (LANG 121)	3	Group III (LANG 122)	3	
	Elective (or Group IV)	3	Group IV	3	
	<b>Semester Total</b>	<b>16</b>		<b>16</b>	<b><u>32</u></b>
					<b>64</b>
Junior	MATH 520 (or 524)	3	MATH 527 (or 570)	3	
	MATH 554/546 (or 511)	3	MATH 5xx (or 555/547)	3	
	LANG 121 (or Group III)	4	STAT 512	3	
	Cognate/Minor	3	LANG 122 (or Group III)	3	
	Minor/Elective	3	Cognate/Minor	3	
	<b>Semester Total</b>	<b>16</b>		<b>15</b>	<b><u>31</u></b>
					<b>95</b>
Senior	MATH 524 (or 520)	3	MATH 546 or 554	3	
	MATH Elective	3	Minor/Elective	3	
	Cognate/Minor	3	Elective	3	
	Cognate/Minor	3	Elective	3	
	Elective	3	Elective	3	
	Elective	3			
	<b>Semester Total</b>	<b>18</b>		<b>15</b>	<b><u>33</u></b>
					<b>Total 128</b>

# Sample Program of Study for the Actuarial Mathematics and Statistics Emphasis and a Minor in Risk Management & Insurance (without Math 300)

## B. S. in Mathematics

Cognate/Minor: Risk Management and Insurance

	Fall Semester	Hrs	Spring Semester	Hrs	Total Hrs
Freshman	MATH 141	4	MATH 142	4	
	ENGL 101	3	ENGL 102	3	
	Group V	4	Group V	4	
	HIST 1xx	3	HIST 1yy	3	
	Group IV (or Univ 101)	3	Group III	3	
	Semester Total	17	17		<u>34</u>
					34
Sophomore	MATH 241	3	MATH 574	3	
	MATH 511	3	STAT 512	3	
	LANG 121	4	LANG 122	3	
	Group III	3	Elective (or Group IV)	3	
	ACCT 222	3	ECON 224	3	
	Semester Total	16	15		<u>31</u>
					65
Junior	MATH 526 (or 544)	3	MATH 520 (or 570)	3	
	STAT 513	3	MATH 554 (or 546)	3	
	CSCE 145	4	STAT 517 (or CSCE 146)	3	
	Group IV (SOCY 310)	3	STAT 512	3	
	FINA 341	3	FINA 363	3	
	Semester Total	17	15		<u>31</u>
					97
Senior	MATH 524 (or 520)	3	MATH 546 (or 554)	3	
	STAT/BA Elective	3	STAT/BA Elective	3	
	Elective	3	Cognate/Minor	3	
	Elective	3	Elective	3	
	Elective	3	Elective	3	
	Elective (if necessary)	3			
	Semester Total	18	15		<u>33</u>
				Total	130

## Sample Program of Study for the General Track

### B. S. in Mathematics with Distinction

Cognate/Minor: \_\_\_\_\_

	Fall Semester	Hrs	Spring Semester	Hrs	Total Hrs
Freshman	MATH 141	4	MATH 142	4	
	ENGL 101	3	ENGL 102	3	
	Group V	4	Group V	4	
	HIST 1xx	3	HIST 1yy	3	
	Group IV (or UNIV101)	3	Group IV (or Group III)	3	
	Semester Total	17	17		<u>34</u>
					34
Sophomore	MATH 241	3	MATH 544 (or 526)	3	
	MATH 574	3	MATH 552, 550, or 534	3	
	CSCE 145	4	Group III	3	
	Group III (or Group IV)	3	Group IV (or Elective)	3	
	Elective	3	Cognate/Minor	3	
	Semester Total	16	15		<u>31</u>
					65
Junior	MATH 554 or 546	3	MATH 555 or 547	3	
	MATH 520	3	MATH 5xx	3	
	STAT 509, 511, or 515	3	STAT 512 or 516	3	
	LANG 121	4	LANG 122	3	
	Cognate/Minor	3	Cognate/Minor	3	
	Semester Total	16	15		<u>31</u>
					96
Senior	MATH 546 or 554	3	MATH 547 or 555	3	
	MATH 5yy	3	MATH Elective	3	
	MATH Elective	3	MATH 499	3	
	MATH 499	3	Elective	3	
	Minor/Elective	3	Elective	3	
	Elective	3			
	Semester Total	18	15		<u>33</u>
				Total	129

# Sample Program of Study for General Mathematics

## B. S. in Mathematics with Distinction

Cognate/Minor: \_\_\_\_\_

	Fall Semester	Hrs	Spring Semester	Hrs	Total Hrs
<b>Freshman</b>	Math 141	4	Math 142	4	
	Engl 101	3	Engl 102	3	
	Group V	4	Group V	4	
	Hist 1xx	3	Hist 1yy	3	
	Group IV (or Univ 101)	3	Group IV (or Group III)	3	
	<b>Semester Total</b>	<b>17</b>		<b>17</b>	<b>34</b>
					<b>34</b>
<b>Sophomore</b>	Math 241	3	Math 544 (or 526)	3	
	Math 574	3	Math 552, 550, or 534	3	
	CSCE 145	4	Group III	3	
	Lang 121	4	Lang 122	3	
	Elective	3	Cognate/Minor	3	
	<b>Semester Total</b>	<b>17</b>		<b>15</b>	<b>32</b>
					<b>66</b>
<b>Junior</b>	Math 554 or 546	3	Math 555 or 547	3	
	Math 520	3	Math 5xx	3	
	Stat 509, 511, or 515	3	Stat 512 or 516	3	
	Group III (or Group IV)	3	Elective (or Group IV)	3	
	Cognate/Minor	3	Cognate/Minor	3	
	<b>Semester Total</b>	<b>15</b>		<b>15</b>	<b>30</b>
					<b>96</b>
<b>Senior</b>	Math 546 or 554	3	Math 547 or 555	3	
	Math 5yy	3	Math Elective	3	
	Math 5zz	3	Elective	3	
	Math 499	3	Elective	3	
	Minor/Elective	3	Elective	3	
	Elective	3			
	<b>Semester Total</b>	<b>18</b>		<b>15</b>	<b>33</b>
					<b>129</b>

# Individual Program of Study for

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## B. S. in Mathematics

Major Emphasis: \_\_\_\_\_ Cognate/Minor: \_\_\_\_\_

	Fall Semester	Hrs	Spring Semester	Hrs	Summer Semester	Hrs	Total Hrs
Freshman							
Semester Total							

Sophomore							
Semester Total							

Junior							
Semester Total							

Senior							
Semester Total							

## Graduation Checklist for B.S. in Mathematics

Major Emphasis: \_\_\_\_\_

Cognate/Minor: \_\_\_\_\_

	Course	Credit Hrs	Grade
<b>Group I</b> (Competency)	ENGL 101		
	ENGL 102		
	LANG		
	LANG		
	LANG 122		
	HIST 10		
	HIST 1		
	Hrs Earned	0	
Hrs Req'd	12 -- 21		

<b>Group II</b> (Quantitative)	MATH 115		
	MATH 141		
	MATH 142		
	CSCE 145		
Hrs Earned	0		
Hrs Req'd	12 -- 16		

<b>Pre-Major</b>	MATH 241		
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<b>Major</b>	MATH 520		
	MATH 526/544		
	MATH 546		
	MATH 554		
	MATH 574		
	MATH 5		
	MATH 5		
Hrs Earned	0		
Hrs Req'd	24 --25		

<b>Statistics</b>			
Hrs Earned	0		
Hrs Req'd	6		

<b>Math Electives</b>	MATH		
	MATH		
	MATH		
	MATH		
Hrs Earned	0		
Hrs Req'd	0		

	Course	Credit Hrs	Grade
<b>Group III</b> (Humanities)			
Hrs Earned	0		
Hrs Req'd	6		

<b>Group IV</b> (Social Sciences)			
Hrs Earned	0		
Hrs Req'd	6		

<b>Group V</b> (Lab Sciences)			
Hrs Earned	0		
Hrs Req'd	8		

<b>Cognate/Minor</b>			
Hrs Earned	0		
Hrs Req'd	12 -- 18		

<b>Elective</b>	UNIV 101		
Hrs Earned	0		
Hrs Req'd	12 -- 18		

	Total Hours Earned	0
	Total Hours Required	128

An electronic copy of this document, including an Excel spreadsheet for the Sample Programs, Individual Program of Study, and Graduation Checklist can be found on the Department of Mathematics website:

<http://www.math.sc.edu/ugradprogram.html>

A two-page color brochure with information about the Department of Mathematics can be downloaded in two different formats:

Word: <http://www.math.sc.edu/undergrad/MathBrochure19May2005.doc>

PDF: <http://www.math.sc.edu/undergrad/MathBrochure19May2005.pdf>

The web address for the Department of Mathematics homepage is  
<http://www.math.sc.edu/>

The web address for the College of Arts and Sciences (CAS) homepage is  
<http://www.cas.sc.edu/>