

## MATHEMATICS B.S.MS.

All students must meet the University Requirements.

### MATHEMATICS MAJOR

The mathematics curriculum is quite flexible. It is designed to provide a sound basic training in mathematics that allows a student to experience the broad sweep of mathematical ideas and techniques, to utilize the computer in mathematics, and to develop an area of special interest in the mathematical sciences.

A Bachelor of Arts with a major in mathematics is offered and supervised by the College of Arts and Sciences. Students opting for this degree require an advisor from the Department of Mathematics and Statistics. Refer to the CAS section of this catalogue for more information.

Concentrations that provide suggested preparation for a student's career plans are listed in the next section, along with the courses recommended for each concentration.

#### Recommendations for Major Courses

In consultation with their advisor, students should choose an area of interest within the mathematics major and plan a coherent program that addresses their interests in mathematics and its applications. This area might be one of those listed below, or it might be another area suggested by the student. As a guide, students interested in one of the areas would typically take at least three courses in that area, including all of the courses marked with an asterisk (\*). In addition, students should take courses from at least two other areas. Because of its centrality in mathematics, students should make sure that they take at least one course listed under Classical Mathematics. In following these recommendations, a course listed in more than one area is meant to be counted only once.

#### 1. CLASSICAL MATHEMATICS

Classical mathematics encompasses those areas having their roots in the great traditions of mathematical thought, such as geometry and topology, mathematical analysis, algebra and number theory, and discrete mathematics. Courses in this area include the following:

MATH 141	Real Analysis in One Variable	3
MATH 151	Groups and Rings	3
MATH 173	Basic Combinatorial Theory	3
MATH 236	Calculus of Variations	3
MATH 240	Fourier Series&Integral Trans	3
MATH 241	Anyl in Several Real Vars I *	3
MATH 242	Anyl Several Real Variables II	3
MATH 251	Abstract Algebra I *	3
MATH 252	Abstract Algebra II	3

MATH 255	Elementary Number Theory	3
MATH 257	Topics in Group Theory	3
MATH 260	Foundations of Geometry	3
MATH 264	Vector Analysis	3
MATH 273	Combinatorial Graph Theory	3
MATH 331	Theory of Func of Complex Var	4
MATH 353	Point-Set Topology	3

#### 2. APPLIED MATHEMATICS

Applied mathematics involves the use of mathematical methods to investigate problems originating in the physical, biological, and social sciences, and engineering. Mathematical modeling, coupled with the development of mathematical and computational solution techniques, illuminates mechanisms which govern a problem and allows predictions to be made about an actual physical situation. Current research interests of the faculty include biomedical mathematics, fluid mechanics and hydrodynamic stability, asymptotics, and singular perturbation theory. Courses in this area include the following:

MATH 230	Ordinary Differential Equation *	3
MATH 236	Calculus of Variations	3
MATH 237	Intro to Numerical Analysis *	3
MATH 238	Applied Computational Methods	3
MATH 240	Fourier Series&Integral Trans	3
MATH 272	Applied Analysis	3
MATH 273	Combinatorial Graph Theory	3
MATH 274	Numerical Linear Algebra	3

#### 3. COMPUTATIONAL MATHEMATICS

Computational mathematics involves both the development of new computational techniques and the innovative modification and application of existing computational strategies to new contexts where they have not been previously employed. Intensive computation is central to the solution of many problems in areas such as applied mathematics, number theory, engineering, and the physical, biological and natural sciences. Computational mathematics is often interdisciplinary in nature, with algorithm development and implementation forming a bridge between underlying mathematical results and the solution to the physical problem of interest. Courses in this area include the following:

MATH 173	Basic Combinatorial Theory	3
MATH 230	Ordinary Differential Equation	3
MATH 237	Intro to Numerical Analysis *	3

MATH 238	Applied Computational Methods	3
MATH 274	Numerical Linear Algebra	3
STAT 201	Stat Computing & Data Analysis	3

#### 4. THEORY OF COMPUTING

The mathematical theory of computing deals with the mathematical underpinnings allowing effective use of the computer as a tool in problem solving. Aspects of the theory of computing include: designing parallel computing strategies (graph theory), analyzing strengths and effectiveness of competing algorithms (analysis of algorithms), examining conditions which ensure that a problem can be solved by computational means (automata theory and computability), and rigorous analysis of run times (complexity theory). Courses in this area include the following:

MATH 173	Basic Combinatorial Theory	3
MATH 273	Combinatorial Graph Theory	3
CS 224	Algorithm Design & Analysis *	3
CS 243	Theory of Computation	3

#### 5. MATHEMATICS OF MANAGEMENT

Mathematics of Management involves the quantitative description and study of problems particularly concerned with the making of decisions in an organization. Problems are usually encountered in business, government, service industries, etc., and typically involve the allocation of resources, inventory control, product transportation, traffic control, assignment of personnel, and investment diversification. Courses in this area include the following:

MATH 173	Basic Combinatorial Theory	3
MATH 221	Deterministic Modls Oper Rsch *	3
MATH 222	Stochastic Models in Oper Rsch	3
MATH 230	Ordinary Differential Equation	3
MATH 236	Calculus of Variations	3
MATH 273	Combinatorial Graph Theory	3
STAT 141	Basic Statistical Methods	3
or STAT 211	Statistical Methods I	
STAT 151	Applied Probability	3
or MATH 207	Probability Theory	
STAT 224	Stats for Quality&Productivity	3
STAT 241	Statistical Inference	3
STAT 253	Appl Time Series & Forecasting	3

#### 6. ACTUARIAL MATHEMATICS

Actuaries use quantitative skills to address a variety of risk related problems within financial environments. A unique feature of the actuarial profession is that a considerable amount of the formal training is typically completed after graduation “on-the-job”.

The Society of Actuaries is an international organization that regulates education and advancement within the profession. Candidates may earn designation as an Associate of the Society of Actuaries (ASA) by satisfying three general requirements. These are:

1. Preliminary Education Requirements, PE;
2. the Fundamentals of Actuarial Practice Course, FAP; and
3. the Associateship Professionalism Course, APC.

The multiple component FAP is based on an e-learning format, and can be pursued independently. After completing the PE and at least one of the FAP components, candidates are eligible to register for the one-half day APC.

The Preliminary Education Requirements consist of

1. prerequisites
2. subjects to be validated by educational experience (VEE), and
3. four examinations.

While at the university, students can satisfy the prerequisites, the VEE courses, and the first two preliminary examinations. The following courses are recommended as preparation for the specific requirements.

##### Prerequisites

<b>Calculus</b>		
MATH 021	Calculus I	4
MATH 022	Calculus II	4
MATH 121	Calculus III	4
<b>Linear Algebra</b>		
MATH 124	Linear Algebra	3
<b>Introductory Accounting</b>		
BSAD 060	Financial Accounting	3
BSAD 061	Managerial Accounting	3
<b>Mathematical Statistics</b>		
STAT 261	Statistical Theory	3

These are topics that will assist candidates in their exam progress and work life but will not be directly tested or validated.

##### Subjects Validated by Educational Experience

<b>Economics</b>	
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EC 011	Principles of Macroeconomics	3
EC 012	Principles of Microeconomics	3
<b>Corporate Finance</b>		
BSAD 180	Managerial Finance	3
BSAD 181	Intermediate Financial Mgmt	3
<b>Applied Statistical Methods</b>		
STAT 221	Statistical Methods II	3
STAT 253	Appl Time Series & Forecasting	3

Candidates will demonstrate proficiency in these subjects by submitting transcripts.

#### Preliminary Examinations

<b>Exam P - Probability</b>		
STAT 151	Applied Probability	3
STAT 251	Probability Theory	3
<b>Exam FM - Mathematics of Finance</b>		
BSAD 180	Managerial Finance	3
BSAD 181	Intermediate Financial Mgmt	3

Other applicable departmental courses include:

STAT 195	Intermediate Special Topics	1-18
STAT 201	Stat Computing & Data Analysis	3
STAT 225	Applied Regression Analysis	3
STAT 229	Survival/Logistic Regression	3
STAT 235	Categorical Data Analysis	3
STAT 237	Nonparametric Statistical Mthd	3
MATH 173	Basic Combinatorial Theory	3
MATH 221	Deterministic Modls Oper Rsch	3
MATH 222	Stochastic Models in Oper Rsch	3

## 7. PROBABILITY AND STATISTICAL THEORY

Probabilistic reasoning is often a critical component of practical mathematical analysis or risk analysis and can usefully extend classical deterministic analysis to provide stochastic models. It also provides a basis for statistical theory, which is concerned with how inferences can be drawn from real data in any of the social or physical sciences. Courses in this area include the following:

MATH 222	Stochastic Models in Oper Rsch	3
MATH 241	Anyl in Several Real Vars I	3

MATH 242	Anyl Several Real Variables II	3
MATH 207	Probability Theory *	3
or STAT 151	Applied Probability	
STAT 241	Statistical Inference *	3
STAT 252	Appl Discr Stochas Proc Models (a)	1
STAT 252	Appl Discr Stochas Proc Models (b)	1
STAT 261	Statistical Theory	3

#### Recommendations for Allied Field Courses

Students should discuss Allied Field courses with their advisor and choose ones that complement their mathematical interests. Students with certain mathematical interests are advised to emphasize an appropriate Allied Field as indicated below and take at least six credits in courses numbered 100 or above in that field.

#### APPLIED MATHEMATICS

Allied Field (1), (2), (3), (4), (6), or (9).

#### COMPUTATIONAL MATHEMATICS

Allied Field (4) or (5).

#### MATHEMATICS OF MANAGEMENT

Allied Field (7). Students interested in Mathematics of Management are advised to include economics (EC 011 and EC 012) in their choice of Humanities and Social Sciences courses, and to include business administration (BSAD 060 and BSAD 061) in their choice of Allied Field courses. Those wishing to minor in business administration should contact the School of Business Administration and also take BSAD 173 and two other courses chosen from business administration Allied Field courses.