Department of Mathematics

West Chester University

Undergraduate Handbook

2018-2019

If you have any questions about any item in the *Handbook*, or if you wish to learn more about the Department of Mathematics at West Chester University, please do not hesitate to contact me:

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Front cover art courtesy of Dr. Andreas Aristotelous

"An example of Newton fractal generated by plotting the starting points of a Newton's iteration applied to a complex valued function. The fractal geometry is created by those starting points that the iteration failed to converge to a root. Coloring here represents the iteration number where the formula found the root within a given tolerance. The fixed point iteration used here is $z=g(z)=z-1/((0.7+0.9*1i)/(z-1)+1/(z+0.5 - 0.866i)+1/(z+0.5 + 0.866i))$"

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Introduction

Mathematics is one of the oldest of all disciplines and it is fundamental for serious scholarship in all of the sciences. Mathematicians use the basic tools of mathematics, including: theory, computational techniques, algorithms, and advanced technology, to solve a wide variety of real world problems. Mathematics is basic to the understanding of many disciplines, including physics, chemistry, computer science, and astronomy.

Mathematics is playing an important role in understanding recent important developments in the biological sciences and many other fields. Mathematical models are frequently used in the social sciences, especially in economics and psychology, and are found throughout actuarial science and statistics. Mathematicians are broadly classified as either pure (theoretical) or applied. The distinction between the two is often somewhat "fuzzy" as the work of both often overlaps.

Theoretical mathematicians advance mathematical knowledge by making new discoveries. They generally seek to increase mathematical knowledge without necessarily having an eye on its practical use. Such abstract theoretical knowledge has often proved to be of practical value as evidenced by the applications of group theory to quantum mechanics and Riemannian geometry to Einstein's work in understanding the nature of the universe.

Applied mathematicians, in contrast, use the theories and tools of mathematics to define and solve practical problems in business; government; engineering; and the physical, biological, and social sciences. For example, they study the most efficient way to schedule postal deliveries between cities; the effectiveness and risks of new drugs, the aerodynamics of a proposed airplane design; or analyze and decipher secret coding used to transmit military, political, or financial information.

Information about careers in mathematics and programs to prepare for students for these careers are described later in the *Handbook.*

Mathematics at West Chester University

Our programs provide close interaction between students and faculty, access to an excellent library, and extensive computer support services. These are all instrumental in providing our students with a solid, undergraduate background in mathematics.

Mission
The Department's mission statement includes the following goals:

- To give students a firm grounding in the ideas and methods of mathematics.
- To develop an understanding and appreciation of the abstract and deductive nature of mathematics.

- To give students an appreciation of the contemporary as well as the historical importance of mathematics.
- To provide students with sufficient skills to enable them to apply their knowledge to related fields of study.
- To prepare students for continued study in graduate school; for a career as a middle or secondary school mathematics teacher; or for a career as an actuary, an applied mathematician, a statistician, or an industrial mathematician.

Faculty
Our faculty hold advanced degrees from major universities. Many have gained both national and international recognition in research and teaching. A list of Department faculty members that includes their contact information is given later in the *Handbook*. Additional information may be found on the Department's website http://www.wcupa.edu/sciences-mathematics/mathematics/.

Quality Teaching
Students pursuing a major or minor in mathematics receive individual attention from our faculty members. The upper division classes for majors are small, ranging in size from five to about 25. We like to think of ourselves as being a friendly, warm, and student-centered department. Students are encouraged to visit their professors during office hours for extra help, if needed.

Auxiliary Teaching Support
The department maintains a Student/Tutorial Center (Room 105) staffed by advanced students. Those that qualify to staff the Tutorial Center acquire pre-professional teaching experience, help their peers, and develop communication skills.

Technical and Related Support
Students have access to several microcomputer labs with full internet access and mathematical, statistical, and programming software, including: Mathematica, Maple, MATLAB, MiniTab, and SAS. These computer labs are located in rooms 103 and 109 next to the Student Tutorial Center. Desktop computers also are available in the Student Tutorial Center (Room 105). The Department has a Seminar Room (Room 104) that includes a small mathematics library. The popular Wednesday afternoon "teas" for both students and faculty are held in room 105.

Careers in Mathematics and Statistics

A graduate who holds a bachelor's degree in mathematics can pursue entry-level positions leading to highly paid positions in both the private and public sectors. Some of these are described below.

Actuary

Actuaries determine future risk, make price decisions, and develop investment strategies. Many also design insurance, financial, and pension plans and help ensure their viability. Most actuaries specialize in life and health or property and causality insurance; others work in finance or employee benefit programs.

In general, actuaries assemble and analyze data to estimate probabilities of an event taking place, such as death, sickness, injury, disability, or property loss. Most are employed in the insurance industry, where they estimate the amount a company will pay in claims. They assure that the price charged for insurance coverage will enable their company to be profitable.

Applicants for beginning actuarial jobs usually have a bachelor's degree in mathematics, actuarial science, statistics, or a business-related discipline such as economics, finance or accounting. Most companies prefer that applicants have passed a few of the actuarial examinations required for professional designation. See www.beanactuary.org for more information.

Commercial Banker

Commercial banks hire more people than any other industry in the financial sector. A graduate may begin in an entry-level position at a branch office, but with the quantitative skills that a degree in mathematical finance offers, a graduate can easily advance into management and specialist positions that use her or his skills to manage the bank's investments. Moreover, this degree prepares graduates for careers in economic forecasting and analysis.

Cryptanalyst

Cryptanalysts develop techniques for the secure transmission of information and they develop techniques for reading information secured by others.

Financial Planner

Financial planners build investment plans for their clients. They gather information from individuals and families regarding their retirement plans and investment goals and decide the best way to reach these goals given their assets. There are a series of exams to take to become a Certified Financial Planner. With many Americans reaching retirement age, there is a growing demand for those with this certification. For more information, see http://www.cfp.net/.

Operations Research Analyst
Operations research and management science are often used to describe the discipline of applying quantitative techniques to make decisions or solve problems. Many of the tools of an operations researcher were developed during World War II in addressing problems related to the deployment of radar, submarine searches, deployment of supplies and weapons, and the breaking of enemy codes. Following the war, numerous peacetime applications emerged placing these specialists in demand.

The emergence of operations research in today's economy reflects the growing complexity of managing large organizations that require efficient use of human, material, and financial resources. In general operations research analysts address questions related to strategy, forecasting, resource allocation, facilities layout, inventory control, personnel allocation, and delivery or distribution systems.

Statistician
Statisticians apply their mathematical knowledge to the design of surveys and experiments. They collect, process, and analyze the data, and interpret the results. Statisticians apply their knowledge to a variety of fields including biology, economics, engineering, medicine, public health, psychology, marketing, and education.

Statisticians often have different professional designations depending on their area of specialization. For example, a statistician working primarily with economic data may be known as an econometrician, while those in public health or medicine may hold titles of biostatistician, biometrician, or epidemiologist.

Teacher
A student who completes the BSEd degree may qualify for an Instructional I Certificate, which is issued by the Pennsylvania Department of Education. This certificate is valid for six years of teaching in Pennsylvania. Recommendation for the Certificate is made by the certifying officer of the University. The BSEd program includes an intensive, year-long field experience and a student teaching experience.

University teaching and research have always been favorite career pursuits for mathematicians. In most four-year colleges and universities, a Ph.D. is necessary for entry into a tenure-track position. Many mathematicians with a master's degree find permanent employment in two-year colleges. Those with either a bachelor's or a master's degree teach at the K-12 level.

Links to Information about Careers in Mathematics
WeUseMath.org
BeAnActuary.org
www.siam.org/careers
www.whydomath.org

Planning Your Program of Study

Starting At West Chester
If you are a first year student, the Department Chair will construct your Fall schedule and assign a Department faculty member as your advisor. If you are a transfer student, you will meet with the Chair, Assistant Chair, or your advisor to plan you first semester schedule.

Scheduling
Students should familiarize themselves with *myWCU*, which allows you to register for classes and monitor progress towards your degree. *myWCU* has a feature called "Degree Progress Report" or "DPR." The DPR allows students to see exactly what requirements have and have not been met. If you are considering changing majors, *myWCU* also has a feature called "What If Degree Progress Report," which allows you to see what requirements have and have not been met for the program you are considering.

Students are strongly encouraged to prepare, print, and review their DPR <u>before</u> meeting with their advisor to schedule courses. Doing so will make your advising meetings more efficient and rewarding because you will know in advance which requirements remain unmet. This allows more time for explaining required and elective mathematics courses; exploring potential minors; discussing your post-graduation plans; and, most importantly, having your advisor serve as a mentor to whom you can turn for help and advice.

The scheduling of classes for a given semester typically takes place during the middle of the preceding semester. Students schedule classes online at *my.wcupa.edu*, using computers located in convenient locations throughout the campus. The *Handbook* contains sample four-year plans for each program.

General Education Requirements
As part of their baccalaureate degrees, all West Chester University students must meet the University's General Education requirements, which include course work in: academic foundations (English composition, mathematics, and public speaking), the natural sciences, behavioral and social sciences, the arts, the humanities, diverse communities (denoted "J"), and interdisciplinary courses (denoted "I"). Additionally, students must complete nine credits in courses designated as "Writing Emphasis" (denoted "W").

Planning Toward Graduation
In spring of your sophomore year, when you are scheduling your junior year, you should take the time to plan your last four semesters at West Chester. Some upper division courses are offered only during Spring or Fall and others are offered only one semester every other year. Thus, if you miss out on a course, it may not be offered for another two years. While you are responsible to see that all graduation requirements are met, your advisor can be a valuable resource.

Baccalaureate Programs

The Department of Mathematics offers three undergraduate degrees:

- **BA Mathematics**. This program prepares students for graduate work in mathematics, applied mathematics, or statistics. The program has a foreign language requirement (French, German, or Russian), so it is ideal for students who want to pursue graduate work at graduate schools that require mastery of a foreign language.

- **BS Mathematics**. This program, which has no foreign language requirement, offers concentrations in actuarial science, applied and computational mathematics, mathematical finance, mathematics, and statistics. The mathematics option prepares students for graduate work in pure mathematics and the other four concentrations prepare students for careers in applied mathematics.

- **BSEd Mathematics**. This program prepares students for teacher certification in grades 7-12. (This degree does not have a foreign language requirement.)

All three degrees require the same five, lower division courses:

MAT 161 Calculus I (4 credits)
MAT 162 Calculus II (4 credits)
MAT 261 Calculus III (4 credits)
MAT 200 The Nature of Mathematics (3 credits)
MAT 311 Linear Algebra (3 credits)

The Calculus sequence (MAT 161, MAT 162, and MAT 261) provides the foundation for nearly every upper division mathematics course. The Nature of Mathematics (MAT 200) includes mathematical notation and argument, structure of proofs, basic facts about logic, mathematical proofs, problem-solving techniques, and introductions to mathematical software packages. MAT 200 is designed to help students successfully transition from the Calculus sequence to upper division mathematics. Linear Algebra (MAT 311) includes matrices, systems of linear equations, vector spaces, linear transformation, determinants, eigenvalues, spectral theorem, and triangulation. Together, these five courses provide a solid foundation for success in upper division mathematics courses.

BA Mathematics

In the first two years, mathematics majors are given a solid foundation through courses that capture their interest and encourage them to continue in the mathematics program. As upper division students, mathematics majors are given a well-rounded introduction to higher mathematics. The curriculum requires two courses at an advanced level in each of the fundamental areas of algebra, analysis, and applied mathematics. Students in the BA

program are also required to complete a minor in a related field (or an additional nine credits of upper division mathematics) in order to enhance their appreciation and preparation for applications of mathematics. By careful selection of courses in the major and in the minor, students in the BA program will be prepared for critical analysis and problem solving positions in many areas of industry, government, or education.

Lower Division, Required Core Courses
MAT 161 Calculus I (4)
MAT 162 Calculus II (4)
MAT 200 The Nature of Mathematics (3)
MAT 261 Calculus III (4)
MAT 311 Linear Algebra (3)

Upper Division Required Courses
MAT 411 Algebra I (3)
MAT 421 Mathematical Statistics I (3)
MAT 441 Real Analysis I (3)

Upper Division Elective Courses[1]
Upper division electives in mathematics are to be taken as follows:
One course in algebra,
One course in analysis,
One course in applied mathematics, and
An additional 12 credits in upper division mathematics courses.

Cognate Requirements
PHY 170 Physics I (4)
CSC 141 Computer Science I (3)

Foreign Language Requirement
The requirements for the BA degree include a foreign language. The equivalent of completing the second half of the intermediate year of an approved foreign language: Russian, French, or German (without the culture cluster option) is strongly recommended.

Requirement of a Minor
Students completing the BA degree are required to complete either a minor or, with the prior approval of the student's advisor and the Chair, an additional nine (9) credit hours of upper division mathematics. The discipline chosen for the minor should reflect the career goals of the student.

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[1] The table that lists courses by area (e.g., algebra, analysis, applied mathematics) is given on page 30.

FALL 2018/ SPRING 2019 B.A. MATHEMATICS – 120 CREDITS

GENERAL EDUCATION REQUIREMENT (48 LESS 9 ATTRIBUTED TO MAJOR REQUIREMENTS = 39 CREDITS)		
	CREDITS	SEMESTER
WRT 120	3	
WRT 200, 204, 205, 206, 208, or 220	3	
MATHEMATICS (MAT 311 below)	3	
SPK 208 OR 230	3	
DIVERSE COMMUNITIES "J" COURSE	3	
INTERDISCIPLINARY "I" COURSE	3	
SCIENCE (3 CREDITS OF PHY 170 BELOW)	3	
SCIENCE (CSC 141)	3	
BEHAVIOR & SOCIAL SCI (ANT, SOC, ECO, GEO, OR PSC)	3	
BEHAVIOR & SOCIAL SCI (ANT, SOC, ECO, GEO, OR PSC)	3	
HUMANITIES (PHI, HIS, LIT, OR CLS)	3	
HUMANITIES (PHI, HIS, LIT, OR CLS)	3	
ARTS (ART CINEMATOGRAPHY MUSIC PHOTOGRAPHY THEATRE)	3	
GENERAL EDUCATION ELECTIVE	3	
GENERAL EDUCATION ELECTIVE	3	
GENERAL EDUCATION ELECTIVE	3	
WRITING INTENSIVE COURSES:		
FOREIGN LANGUAGE REQUIREMENT (12 CREDITS)		
LANGUAGE 101	3	
LANGUAGE 102	3	
LANGUAGE 201	3	
LANGUAGE 202	3	
RELATED REQUIREMENTS (7 CREDITS)		
CSC 141 COMPUTER SCIENCE I	3	
PHY 170 PHYSICS I	4	
MATHEMATICS CORE REQUIREMENTS (18 CREDITS)		
MAT 161 CALCULUS I	4	
MAT 162 CALCULUS II	4	
MAT 200 NATURE OF MATHEMATICS	3	
MAT 261 CALCULUS III	4	
MAT 311 LINEAR ALGEBRA	3	
BA MATHEMATICS REQUIREMENTS (24 CREDITS)		
MAT 411 ABSTRACT ALGEBRA	3	
MAT 421 MATHEMATICAL STATISTICS I	3	
MAT 441 REAL ANALYSIS I	3	
ANALYSIS ELECTIVE: MAT 343, 432, 442, 444, 445	3	
APPLIED MATH ELECTIVE: MAT 319, 325, 343, 371, 422, 423, 425, 427, 478 , 479, 493	3	
ALGEBRA ELECTIVE: MAT 321, 412, 413, 414	3	
MATHEMATICS ELECTIVE (300 LEVEL AND HIGHER)	3	
MATHEMATICS ELECTIVE (300 LEVEL AND HIGHER)	3	
MINOR REQUIREMENTS AND FREE ELECTIVES (20 CREDITS)		
MINOR ELECTIVE	3	
MINOR ELECTIVE	3	
MINOR ELECTIVE	3	
MINOR ELECTIVE	3	
MINOR ELECTIVE	3	
MINOR ELECTIVE	3	
FREE ELECTIVE	2	

B.A. Mathematics
Sample Course Plan
Students Admitted Fall 2018/Spring 2019

Year	Fall	Spring
1	MAT 161 CSC 141 Language 101 Gen Ed Humanities Gen Ed Behavioral/Social Science	MAT 162 MAT 200 WRT 120 Language 102 PHY 170
2	MAT 261 MAT 311 WRT 200-level Language 201 Minor Elective	SPK 208 or 230 Applied Mathematics Elective Language 202 Minor Elective Gen Ed Arts
3	MAT 411 MAT 421 IW Course Minor Elective Gen Ed Elective	MAT 441 Algebra Elective Minor Elective Mathematics Elective JW Course
4	Analysis Elective Mathematics Elective Minor Elective Gen Ed Humanities Gen Ed Elective	Mathematics Elective Minor Elective Gen Ed Behavioral/Social Science Gen Ed Elective Free Elective

General Notes:
- Three writing-emphasis (W) courses are required. At least one of them must be at the three hundred level or above. Transfer students entering with 40-70 credits must take two writing emphasis courses and those entering with more than 70 credits must take one.
- Students are encouraged to take courses that meet multiple requirements, for example, courses that are both "W" and "J" courses.

BS in Mathematics

The BS degree prepares students for careers in applied mathematics (actuarial science, computational mathematics, financial mathematics, industrial mathematics, or statistics) or pure mathematics. The main difference between the BA Mathematics Program and the BS Mathematics Program is that the BA has a foreign language requirement, while the BS does not.

Lower Division, Required Core Courses
    MAT 161 Calculus I (4)
    MAT 162 Calculus II (4)
    MAT 200 The Nature of Mathematics (3)
    MAT 261 Calculus III (4)
    MAT 311 Linear Algebra (3)

Upper Division, Required Courses by Program

Actuarial Science	Applied & Computational
MAT 343	MAT 325
MAT 371	MAT 343
MAT 421	MAT 413
MAT 422	MAT 425
MAT 423	MAT 443
MAT 478	MAT 427 or MAT 493
STA 311	MAT 445 or MAT 441
STA 319	MAT 455
	STA 319

Financial	Mathematics	Statistics
MAT 343	MAT 343	MAT 125
MAT 371	MAT 411	MAT 343
MAT 421	MAT 421	MAT 421
MAT 479	MAT 441	MAT 422
MAT 422 or MAT 423	MAT 445	MAT 423
STA 319	Analysis Elective	STA 311
	Applied Elective	STA 319
	Algebra Elective	STA 320
	MAT Elective*	STA 321
	MAT Elective*	STA 490
	MAT Elective*	

*Mathematics MAT electives to be chosen above 311 but not MAT 350, MAT 354, MAT 360, or MAT 364.
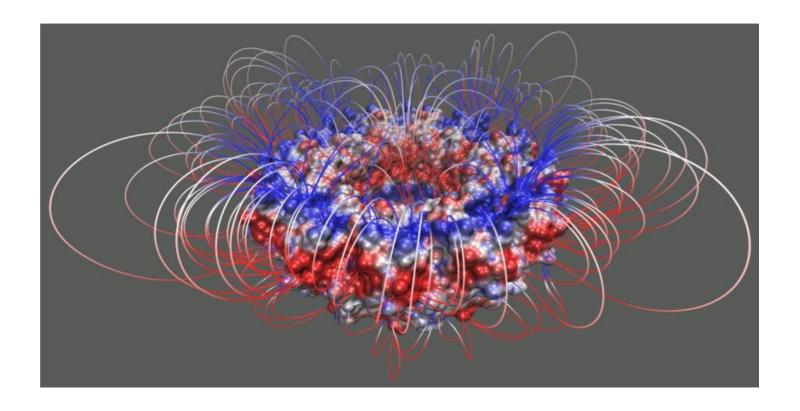
Figure caption: This computer-generated figure shows the electrostatic potential distribution map (blue and red colors) on the surface of a live protein by solving the Poisson Boltzmann Equation (PBE) on this protein. Force field curves indicate the paths electrons are delivered from negatively charged sites (red) to positively charged sites (blue).
Provided by Dr. Chuan Li.

Fall 2018/ Spring 2019 B.S. MATHEMATICS: ACTUARIAL SCIENCE – 120 CREDITS

GENERAL EDUCATION REQUIREMENTS (48 LESS 9 ATTRIBUTED TO MAJOR REQUIREMENTS = 39 CREDITS)	CREDITS	SEMESTER
WRT 120	3	
WRT 200, 204, 205, 206, 208, or 220	3	
MATHEMATICS (MAT 311 below)	3	
SPK 230 (below)	3	
DIVERSE COMMUNITIES "J" COURSE	3	
INTERDISCIPLINARY "I" COURSE	3	
SCIENCE (BIO, CHE, PHY, CSC, OR ESS)	3	
SCIENCE (BIO, CHE, PHY, CSC, OR ESS)	3	
BEHAVIOR & SOCIAL SCI (ECO 111 below)	3	
BEHAVIOR & SOCIAL SCI (ANT, SOC, GEO, PSY, OR PSC)	3	
HUMANITIES (PHI, HIS, LIT, OR CLS)	3	
HUMANITIES (PHI, HIS, LIT, OR CLS)	3	
ARTS (ART CINEMATOGRAPHY MUSIC PHOTOGRAPHY THEATRE)	3	
GENERAL EDUCATION ELECTIVE	3	
GENERAL EDUCATION ELECTIVE	3	
GENERAL EDUCATION ELECTIVE	3	
WRITING INTENSIVE COURSES: ENG 368, 371, OR 375 , AND 2 OTHERS		
*****NOTE TO STUDENTS AND ADVISORS: I/J COURSES MAY NOT COUNT AS DISTRIBUTIVE REQUIREMENTS*****		
INTERNSHIP OR ELECTIVES (15 CREDITS)		
MAT 491 INTERNSHIP IN APPLIED MATHEMATICS** (OPTIONAL)	3	
FREE ELECTIVE***	3	
FREE ELECTIVE***	3	
FREE ELECTIVE***	3	
FREE ELECTIVE***	3	

* MAT 421 SHOULD BE TAKEN IMMEDIATELY AFTER MAT 261

** MAY BE TAKEN FOR VARIABLE CREDIT AND REPEATED FOR CREDIT.

*** MUST BE APPROVED BY ADVISOR.

BS MATHEMATICS REQUIREMENTS (21 CREDITS)	CREDITS	SEMESTER
MAT 161 CALCULUS I	4	
MAT 162 CALCULUS II	4	
MAT 200 NATURE OF MATHEMATICS	3	
MAT 261 CALCULUS III*	4	
MAT 311 LINEAR ALGEBRA	3	
MAT 343 DIFFERENTIAL EQUATIONS		
CONCENTRATION COURSES (21 CREDITS)		
MAT 125 INTRODUCTION TO STATISTICS AND PROBABILITY		
MAT 371 MATHEMATICAL FINANCE	3	
MAT 421 MATHEMATICAL STATISTICS I*	3	
MAT 422 MATHEMATICAL STATISTICS II	3	
MAT 478 FUNDAMENTALS OF ACTUARIAL SCIENCE	3	
STA 319 APPLIED STATISTICS	3	
STA 419 BASICS OF STATISTICAL LEARNING	3	
COGNATE REQUIREMENTS (24 CREDITS)		
ACC 201 ACCOUNTING 1	3	
ECO 111 PRINCIPLES OF MACROECONOMICS	3	
ECO 112 PRINCIPLES OF MICROECONOMICS	3	
ECO 340 INTERMEDIATE ECONOMICS	3	
FIN 325 CORPORATE FINANCE	3	
FIN 330 PRINCIPLES OF INSURANCE	3	
SPK 230 BUSINESS/PROFESSIONAL SPEECH	3	
ENG 368, ENG 371, ENG 375 TECHNICAL /BUSINESS WRITING	3	

PRE-MBA COURSES MUST BE PASSED WITH A "B" OR BETTER.

A GMAT score of 460 (or its equivalent GRE score) is required for admission to the M.B.A. program. The GMAT requirement will be waived, if your overall GPA is at least 3.3 and you earn a B or better in each of the following courses: Management, Accounting, Marketing, Economics, Finance, and Statistics

B.S. Mathematics – Actuarial Science
Sample Course Plan
Students Admitted
Fall 2018/Spring 2019

Year	Fall	Spring
1	MAT 161 ACC 201 MAT 125 Gen Ed Humanities Gen Ed Science	MAT 162 MAT 200 WRT 120 SPK 230 ECO 111
2	MAT 261* MAT 311 MAT 371 ECO 112 WRT 200	MAT 421* STA 319 FIN 325 Gen Ed Behavioral/Social Sciences Gen Ed Science
3	STA 419 FIN 330 IW Course Free Elective*** Gen Ed Elective	MAT 422 MAT 343 ECO 340 JW Course Free Elective***
4	Gen Ed Arts ENG 368 W Gen Ed Humanities Gen Ed Elective Free Elective***	MAT 478 MAT 491 Internship** Gen Ed Elective Free Elective***

General Notes:
- Three writing-emphasis (W) courses are required. At least one of them must be at the three hundred level or above. Transfer students entering with 40-70 credits must take two writing emphasis courses and those entering with more than 70 credits must take one.
- Students are encouraged to take courses that meet multiple requirements, for example, courses that are both "W" and "J" courses.

Program Specific Notes:
  *MAT 421 should be taken immediately after MAT 261.
  ** May be taken for variable credit and repeated for credit.
  ***Must be approved by advisor.

  Students interested in the BS-MBA 4+1 program must take at least one 300-level or higher management course and at least one 300-Level or higher marketing course.

FALL 2018/SPRING 2019 B.S. MATHEMATICS: APPLIED AND COMPUTATIONAL MATHEMATICS– 120 CREDITS

GENERAL EDUCATION REQUIREMENTS (48 LESS 12 ATTRIBUTED TO MAJOR REQUIREMENTS = 36 CREDITS)		
	CREDITS	SEMESTER
WRT 120	3	
WRT 200, 204, 205, 206, 208, or 220	3	
MATHEMATICS (MAT 311 below)	3	
SPK 230 (below)	3	
DIVERSE COMMUNITIES "J" COURSE	3	
INTERDISCIPLINARY "I" COURSE	3	
SCIENCE (CSC 141 below)	3	
SCIENCE (PHY 170, BIO 110, CHE 103, or ESS 101 below)	3	
BEHAVIOR & SOCIAL SCI (ANT, SOC, ECO, GEO, OR PSC)	3	
BEHAVIOR & SOCIAL SCI (ANT, SOC, ECO, GEO, OR PSC)	3	
HUMANITIES (PHI, HIS, LIT, OR CLS)	3	
HUMANITIES (PHI, HIS, LIT, OR CLS)	3	
ARTS (ART CINEMATOGRAPHY MUSIC PHOTOGRAPHY THEATRE)	3	
GENERAL EDUCATION ELECTIVE	3	
GENERAL EDUCATION ELECTIVE	3	
GENERAL EDUCATION ELECTIVE	3	
WRITING INTENSIVE "W" COURSES: ENG 368, 371, OR 375 (SEE BELOW) AND 2 OTHERS. COURSES WITH THE I/J AND W DESIGNATION FULFILL BOTH REQUIREMENTS SIMULTANEOUSLY.		
NOTE TO STUDENTS AND ADVISORS: I COURSES MAY NOT COUNT AS DISTRIBUTIVE REQUIREMENTS.		

COGNATE REQUIREMENTS (24-26 CREDITS)		
CSC 141 COMPUTER SCIENCE I	3	
PHY 170, BIO 110, CHE 103, OR ESS 101	3-4	
COGNATE 1*	3-4	
COGNATE 2*	3	
COGNATE 3*	3	
COGNATE 4*	3	
SPK 230 BUSINESS/PROFESSIONAL SPEECH	3	
ENG 368, ENG 371, OR ENG 375 TECHNICAL /BUSINESS WRITING	3	

* Select 4 Science Cognates (PHY, BIO, CHE, CS, ESS) under guidance of advisor. At least two cognates must be at the 200-level or above. Discuss with your advisor any prerequisites. For example, CSC 220 requires MAT 151.

BS MATHEMATICS REQUIREMENTS (24 CREDITS)		
MAT 161 CALCULUS I	4	
MAT 162 CALCULUS II	4	
MAT 200 NATURE OF MATHEMATICS	3	
MAT 261 CALCULUS III	4	
MAT 311 LINEAR ALGEBRA	3	
MAT 343 DIFFERENTIAL EQUATIONS	3	
CONCENTRATION COURSES (21 CREDITS)		
MAT 125 INTRODUCTION TO STATISTICS AND PROBABILITY	3	
MAT 325 COMPUTATIONAL MATHEMATICS	3	
MAT 413 COMPUTER ALGEBRA	3	
MAT 425 NUMERICAL ANALYSIS	3	
MAT 443 APPLIED ANALYSIS I	3	
ANY ONE: MAT 445 COMPLEX VARIABLES OR MAT 441 REAL ANALYSIS I	3	
MAT 455: INDUSTRIAL MATHEMATICS PRACTICUM	3	
STA 319 APPLIED STATISTICS	3	
INTERNSHIP OR ELECTIVES (13-15 CREDITS)		
MAT 491: INTERNSHIP IN APPLIED MATHEMATICS**	2-4	
FREE ELECTIVES**	13-15	

** All free electives must be approved by advisor. MAT 491 is an elective and may be taken for variable credit and repeated for credit. A minor may be obtained by electing appropriate additional classes in a single scientific discipline. Discuss this option with your advisor.

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B.S. Mathematics: Applied and Computational Mathematics
Sample Course Plan
Students Admitted
Fall 2018/Spring 2019

Year	Fall	Spring
1	MAT 161 (4) MAT 125 (3) CSC 141(3) WRT 120 (3) Gen Ed Behavioral/Social Science (3)	MAT 162 (4) MAT 200 (3) Gen Ed Science (3) SPK 230 (3) Gen Ed Elective (3)
	Fall	Spring
2	MAT 261 (4) MAT 311 (3) Cognate 1 (3) WRT 200 (3) JW Course (3)	MAT 343 (3) MAT 325 (3) Cognate 2 (3) Gen Ed Behavioral/Social Science (3) Gen Ed Humanities (3)
	Fall	Spring
3	MAT 413 (3) MAT 425 Cognate 3 (3) Gen Ed Humanities (3) Gen Ed Elective (3)	STA 319 (3) MAT 443* (3) IW Course (3) ENG 368 W (3) Gen Ed Elective (3)
	Fall	Spring
4	MAT 445* (3) or MAT 441(3) Cognate 4 (3) Gen Ed Elective** (3) Free Elective** (3) Free Elective** (3)	MAT 491** (3) MAT 455 (3) Free Elective** (3) Free Elective** (3)

General Notes:
- Three writing-emphasis (W) courses are required. At least one of them must be at the three hundred level or above. Transfer students entering with 40-70 credits must take two writing emphasis courses and those entering with more than 70 credits must take one.
- Students are encouraged to take courses that meet multiple requirements, for example, courses that are both "W" and "J" courses.

Program Specific Notes:
  *Subject to change. Be sure to check myWCU**.**
** All free electives must be approved by advisor. MAT 491 is an elective and may be taken for variable credit and repeated for credit. A minor may be obtained by electing appropriate additional classes in a single scientific discipline. Discuss this option with your advisor.

Fall 2018/Spring 2019 B.S. Mathematics: Mathematical Finance – 120 credits

GENERAL EDUCATION (48 LESS 12 ATTRIBUTED TO MAJOR REQUIREMENTS = 36 CREDITS)	CREDITS	SEMESTER
WRT 120	3	
WRT 200, 204, 205, 206, 208, or 220	3	
MATHEMATICS (MAT 311 below)	3	
SPK 230 (below)	3	
DIVERSE COMMUNITIES "J" COURSE	3	
INTERDISCIPLINARY "I" COURSE	3	
SCIENCE	3	
SCIENCE (CSC 141 BELOW)	3	
BEHAVIOR & SOCIAL SCI (ECO 111 BELOW)	3	
BEHAVIOR & SOCIAL SCI (ANT, SOC, GEO, PSC, OR PSY)	3	
HUMANITIES (PHI, HIS, LIT, OR CLS)	3	
HUMANITIES (PHI, HIS, LIT, OR CLS)	3	
ARTS (ART CINEMATOGRAPHY MUSIC PHOTOGRAPHY THEATRE)	3	
GENERAL EDUCATION ELECTIVE	3	
GENERAL EDUCATION ELECTIVE	3	
GENERAL EDUCATION ELECTIVE	3	
WRITING INTENSIVE COURSES: ENG 368, 371, OR 375 , AND 2 OTHERS		
*** NOTE TO STUDENTS AND ADVISORS: I/J COURSES MAY NOT COUNT AS DISTRIBUTIVE REQUIREMENTS. ***		
INTERNSHIP OR FREE ELECTIVES (18 CREDITS)		
MAT 491 INTERNSHIP IN APPLIED MATHEMATICS* (OPTIONAL) OR FREE ELECTIVE**	3	
FREE ELECTIVE**	3	
FREE ELECTIVE**	3	
FREE ELECTIVE**	3	
FREE ELECTIVE**	3	
FREE ELECTIVE**	3	

* MAY BE TAKEN FOR VARIABLE CREDIT AND REPEATED FOR CREDIT.

** MUST BE APPROVED BY ADVISOR.

STUDENTS INTERESTED IN THE BS-MBA 4+ 1 PROGRAM MUST TAKE AT LEAST ONE 300-LEVEL OR HIGHER MANAGEMENT COURSE AND AT LEAST ONE 300-LEVEL OR HIGHER MARKETING COURSE.

MATHEMATICS CORE REQUIREMENTS (18 CREDITS)	CREDITS	SEMESTER
MAT 161 CALCULUS I	4	
MAT 162 CALCULUS II	4	
MAT 200 NATURE OF MATHEMATICS	3	
MAT 261 CALCULUS III	4	
MAT 311 LINEAR ALGEBRA	3	
ACTUARIAL SCIENCE MATHEMATICS REQUIREMENTS (24 CREDITS)		
MAT 125 INTRODUCTION TO STATISTICS AND PROBABILITY	3	
MAT 343 DIFFERENTIAL EQUATIONS	3	
MAT 371 MATHEMATICS OF FINANCE (OLD MAT 406)	3	
MAT 479 FINANCIAL CALCULUS (OLD MAT 409)	3	
MAT 421 MATHEMATICAL STATISTICS I	3	
MAT 422 MATHEMATICAL STATISTICS II OR MAT 423 APPLIED PROBABILITY	3	
MAT 443 APPLIED ANALYSIS	3	
STA 319 APPLIED STATISTICS	3	
COGNATE REQUIREMENTS (24 CREDITS)		
ACC 201 ACCOUNTING I	3	
CSC 141 COMPUTER SCIENCE I	3	
ECO 111 PRINCIPLES OF MACROECONOMICS	3	
ECO 112 PRINCIPLES OF MICROECONOMICS	3	
FIN 325 CORPORATE FINANCE	3	
ANY ONE: FIN 337 FINANCIAL MARKETS AND INSTITUTIONS OR FIN 344 INVESTMENTS	3	
SPK 230 BUSINESS/PROFESSIONAL SPEECH	3	
ENG 368, ENG 371, ENG 371 TECHNICAL /BUSINESS WRITING	3	

+PRE-MBA COURSES MUST BE PASSED WITH A "B" OR BETTER.

Note: A GMAT score of 460 (or its equivalent GRE score) is required for admission to the M.B.A. program. The GMAT requirement will be waived, if your overall GPA is at least 3.3 and you earn a B or better in each of the following courses: Management, Accounting, Marketing, Economics, Finance, and Statistics.

B.S. Mathematics: Mathematical Finance
Sample Course Plan
Students Admitted
Fall 2018/Spring 2019

Year	Fall	Spring
1	MAT 161 CSC 141 MAT 125 Gen Ed Behavioral/Social Science Gen Ed Humanities	MAT 162 MAT 200 SPK 230 WRT 120 Gen Ed Science
2	MAT 261 MAT 311 ACC 201 ECO 111 Free Elective	STA 319 MAT 343 ECO 112 Gen Ed Humanities Free Elective
3	MAT 421 MAT 371 – formerly MAT 406 FIN 325 Gen Ed Elective Free Elective	MAT 422* FIN 344 or FIN 337 MAT 443** (or JW Course) Gen Ed Humanities Free Elective
4	MAT 491 Internship or Free Elective IW Course (or MAT 423*) ENG 368 W Gen Ed Elective Free Elective	MAT 479 – formerly MAT 409 JW Course (or MAT 443***) Free Elective Gen Ed Arts

General Notes:
- Three writing-emphasis (W) courses are required. At least one of them must be at the three hundred level or above. Transfer students entering with 40-70 credits must take two writing emphasis courses and those entering with more than 70 credits must take one.
- Students are encouraged to take courses that meet multiple requirements, for example, courses that are both "W" and "J" courses.

Program Specific Notes:
- * Student must take either MAT 422 (a Spring **only** course) or MAT 423 (a Fall **only** course); MAT 421 is a prerequisite for both courses.
- ****** If student starts Year 1 in an odd year, take MAT 443 in Year 3 since MAT 443 **only** offered in Spring of even years.
- ******* If student starts Year 1 in an even year, take MAT 443 in Year 4 since MAT 443 **only** offered in Spring of even years.

Fall 2018/Spring 2019 B.S. Mathematics: Mathematics– 120 credits

GENERAL EDUCATION REQUIREMENTS (48 LESS 12 ATTRIBUTED TO MAJOR REQUIREMENTS = 36 CREDITS)		
	CREDITS	SEMESTER
WRT 120	3	
WRT 200, 204, 205, 206, 208, or 220	3	
MATHEMATICS (MAT 311 below)	3	
SPK 230 (below)	3	
DIVERSE COMMUNITIES "J" COURSE	3	
INTERDISCIPLINARY "I" COURSE (MAT 301 RECOMMENDED)	3	
SCIENCE (CSC 141 BELOW)	3	
SCIENCE (3 CREDITS OF PHY 170 BELOW)	3	
BEHAVIOR & SOCIAL SCI (ANT, SOC, ECO, GEO, OR PSC)	3	
BEHAVIOR & SOCIAL SCI (ANT, SOC, ECO, GEO, OR PSC)	3	
HUMANITIES (PHI, HIS, LIT, OR CLS)	3	
HUMANITIES (PHI, HIS, LIT, OR CLS)	3	
ARTS (ART CINEMATOGRAPHY MUSIC PHOTOGRAPHY THEATRE)	3	
GENERAL EDUCATION ELECTIVE (MAT 125 RECOMMENDED)	3	
GENERAL EDUCATION ELECTIVE (FOREIGN LANGUAGE 201 RECOMMENDED)	3	
GENERAL EDUCATION ELECTIVE (FOREIGN LANGUAGE 202 RECOMMENDED)	3	
WRITING INTENSIVE COURSES: ENG 371 AND 2 OTHERS (MAT 401 RECOMMENDED)		
COGNATE REQUIREMENTS (20 CREDITS)		
SPK 230 BUSINESS SPEAKING	3	
CSC 141 COMPUTER SCIENCE I	3	
PHY 170 PHYSICS I	4	
PHY 180 PHYSICS II	4	
ENG 371 TECHNICAL WRITING (W COURSE)	3	
FREE ELECTIVE**	3	
INDEPENDENT STUDY, W COURSES, AND ELECTIVES (13 CREDITS)		
FREE ELECTIVE* - MAT 499 INDEPENDENT STUDY** RECOMMENDED	1	
W COURSE - MAT 401 RECOMMENDED	3	
W COURSE	3	
FREE ELECTIVE**	3	
FREE ELECTIVE**	3	

CORE MATHEMATICS REQUIREMENTS (18 CREDITS)		
MAT 161 CALCULUS I	4	
MAT 162 CALCULUS II	4	
MAT 200 NATURE OF MATHEMATICS	3	
MAT 261 CALCULUS III	4	
MAT 311 LINEAR ALGEBRA	3	
BS MATHEMATICS CONCENTRATION COURSES (33 CREDITS)		
MAT 343 DIFFERENTIAL EQUATIONS	3	
MAT 411 ALGEBRA	3	
MAT 421 MATHEMATICAL STATISTICS I	3	
MAT 441 REAL ANALYSIS I	3	
MAT 445 COMPLEX VARIABLES	3	
ANALYSIS ELECTIVE: MAT 432, 442, 443, 444	3	
APPLIED MATH ELECTIVE: MAT 319, 325, 343, 371, 422, 423, 425, 427, 478, 479, 493	3	
ALGEBRA ELECTIVE: MAT 321, 412, 413, 414	3	
MATHEMATICS ELECTIVE***	3	
MATHEMATICS ELECTIVE***	3	
MATHEMATICS ELECTIVE***	3	
MATHEMATICS ELECTIVE***	3	

GENERAL NOTES:

- THREE WRITING-EMPHASIS (W) COURSES ARE REQUIRED. AT LEAST ONE OF THEM MUST BE AT THE THREE HUNDRED LEVEL OR ABOVE. TRANSFER STUDENTS ENTERING WITH 40-70 CREDITS MUST TAKE TWO WRITING EMPHASIS COURSES AND THOSE ENTERING WITH MORE THAN 70 CREDITS MUST TAKE ONE.
- STUDENTS ARE ENCOURAGED TO TAKE COURSES THAT MEET MULTIPLE REQUIREMENTS, FOR EXAMPLE, COURSES THAT ARE BOTH "W" AND "J" COURSES.

PROGRAM SPECIFIC NOTES:

* MAY BE TAKEN FOR VARIABLE CREDIT AND REPEATED FOR CREDIT.

** MUST BE APPROVED BY ADVISOR.

*** ANY COURSES IN MATHEMATICS WITH COURSE NUMBERS ABOVE 311, WITH THE EXCEPTION OF THOSE COURSES WITH A PRIMARY FOCUS ON TEACHER TRAINING OR THOSE COURSES RESTRICTED TO STUDENTS MAJORING IN ELEMENTARY EDUCATION.

B.S. Mathematics – Mathematics
Sample Course Plan
Students Admitted
Fall 2018/Spring 2019

Year	Fall	Spring
1	MAT 161 MAT 125 (recommended) CSC 141 Gen Ed Humanities Gen Ed Behavioral/Social Science	MAT 162 MAT 200 PHY 170 WRT 120 SPK 230
2	MAT 261 MAT 311 PHY 180 WRT 200 Gen Ed Arts	MAT 343 Mathematics Elective *** W course MAT 401 (recommended) Free Elective ** Gen Ed Elective
3	MAT 411 MAT 421 Mathematics Elective *** I Course W course	MAT 441 Algebra Elective Mathematics Elective *** J Course Free Elective **
4	MAT 445 Analysis Elective ENG 371 W course Gen Ed Humanities Gen Ed Elective (Foreign Language 201 recommended)	Free Elective MAT 499 (recommended) * Applied Elective Free Elective ** Gen Ed Behavioral/Social Science Gen Ed Elective (Foreign Language 202 recommended)

General Notes:
- Three writing-emphasis (W) courses are required. At least one of them must be at the three hundred level or above. Transfer students entering with 40-70 credits must take two writing emphasis courses and those entering with more than 70 credits must take one.
- Students are encouraged to take courses that meet multiple requirements, for example, courses that are both "W" and "J" courses.

Program Specific Notes:
* May be taken for variable credit and repeated for credit.
** Must be approved by advisor.
*** Any courses in mathematics with course numbers above 311, with the exception of those courses with a primary focus on teacher education or those courses restricted to students majoring in early or middle grades education.

Fall 2018/Spring 2019 B.S. Mathematics: Statistics – 120 credits

GENERAL EDUCATION REQUIREMENTS (48 LESS 6 ATTRIBUTED TO MAJOR REQUIREMENTS = 42 CREDITS)		
	CREDITS	SEMESTER
WRT 120	3	
WRT 200, 204, 205, 206, 208, or 220	3	
MATHEMATICS (MAT 311 below)	3	
SPK 230 (below)	3	
DIVERSE COMMUNITIES "J" COURSE	3	
INTERDISCIPLINARY "I" COURSE	3	
SCIENCE (BIO, CHE, PHY, CSC, OR ESS)	3	
SCIENCE (BIO, CHE, PHY, CSC, OR ESS)	3	
BEHAVIOR & SOCIAL SCI (ANT, SOC, ECO, GEO, OR PSC)	3	
BEHAVIOR & SOCIAL SCI (ANT, SOC, ECO, GEO, OR PSC)	3	
HUMANITIES (PHI, HIS, LIT, OR CLS)	3	
HUMANITIES (PHI, HIS, LIT, OR CLS)	3	
ARTS (ART CINEMATOGRAPHY MUSIC PHOTOGRAPHY THEATRE)	3	
GENERAL EDUCATION ELECTIVE	3	
GENERAL EDUCATION ELECTIVE	3	
GENERAL EDUCATION ELECTIVE	3	
WRITING INTENSIVE COURSES: ENG 368, 371, OR 375, AND 2 OTHERS		
NOTE TO STUDENTS AND ADVISORS: I COURSES MAY NOT COUNT AS DISTRIBUTIVE REQUIREMENTS		
SUPPLEMENTAL REQUIREMENTS (24 CREDITS)		
SUPPLEMENTAL ELECTIVE I	3	
SUPPLEMENTAL ELECTIVE II	3	
SUPPLEMENTAL ELECTIVE III	3	
SUPPLEMENTAL ELECTIVE IV	3	
SUPPLEMENTAL ELECTIVE V	3	
SUPPLEMENTAL ELECTIVE VI	3	
SPK 230 BUSINESS/PROFESSIONAL SPEECH	3	
ENG 368, ENG 371, ENG 371 TECHNICAL /BUSINESS WRITING	3	

BS MATHEMATICS REQUIREMENTS (18 CREDITS)		
	CREDITS	SEMESTER
MAT 161 CALCULUS I	4	
MAT 162 CALCULUS II	4	
MAT 200 NATURE OF MATHEMATICS	3	
MAT 261 CALCULUS III	4	
MAT 311 LINEAR ALGEBRA	3	
CONCENTRATION COURSES (30 CREDITS)		
MAT 125 STATISTICS I	3	
MAT 343 DIFFERENTIAL EQUATIONS	3	
MAT 421 MATHEMATICAL STATISTICS I	3	
MAT 422 MATHEMATICAL STATISTICS II	3	
STA 311 STATISTICAL COMPUTING	3	
STA 319 APPLIED STATISTICS	3	
STA 320 EXPERIMENTAL DESIGN	3	
STA 321 TOPICS IN ADVANCED STATISTICS	3	
STA 419 BASICS OF STATISTICAL LEARNING	3	
STA 490 CAPSTONE COURSE IN STATISTICS	3	
ELECTIVES (6 CREDITS)		
FREE MATH/STAT ELECTIVE	3	
FREE MATH/STAT ELECTIVE*	3	

GENERAL NOTES:
- THREE WRITING-EMPHASIS (W) COURSES ARE REQUIRED. AT LEAST ONE OF THEM MUST BE AT THE THREE HUNDRED LEVEL OR ABOVE. TRANSFER STUDENTS ENTERING WITH 40-70 CREDITS MUST TAKE TWO WRITING EMPHASIS COURSES AND THOSE ENTERING WITH MORE THAN 70 CREDITS MUST TAKE ONE.
- STUDENTS ARE ENCOURAGED TO TAKE COURSES THAT MEET MULTIPLE REQUIREMENTS, FOR EXAMPLE, COURSES THAT ARE BOTH "W" AND "J" COURSES.

PROGRAM SPECIFIC NOTES:
* MUST BE APPROVED BY ADVISOR AND MAY BE AN INTERNSHIP
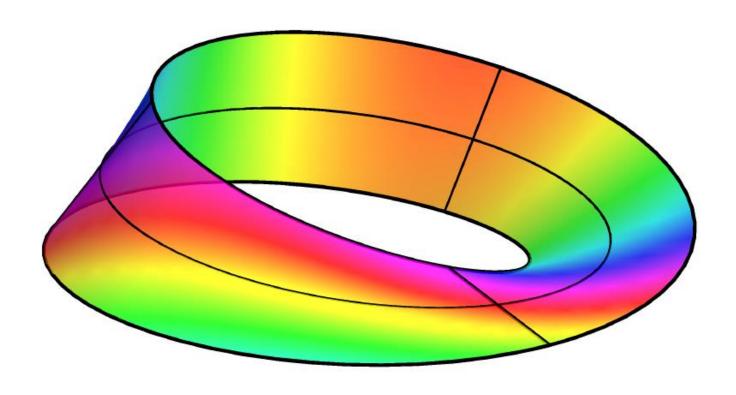
B.S. Mathematics – Statistics
Sample Course Plan

Year	Fall	Spring
1	MAT 125 MAT 161 Gen Ed Science Elective Gen Ed Humanities Gen Ed Behavioral/Social Science	MAT 162 MAT 200 WRT 120 SPK 230 Gen Ed Elective (STA 200 Recommended)
2	MAT 261 MAT 311 WRT 200 Gen Ed Elective Supplemental Elective I	STA 311 STA 319 MAT 343 Gen Ed Arts Supplemental Elective II
3	MAT 421 STA 320 STA 419 IW Course Supplemental Elective III	MAT 422 ENG 368 W STA 321 Gen Ed Behavioral/Social Science Supplemental Elective IV
4	STA 490 Gen Ed Elective JW Course Supplemental Elective V Supplemental Elective VI	Elective in MAT/STA* Elective in MAT/STA* Gen Ed Humanities Gen Ed Science Elective

General Notes:
- Three writing-emphasis (W) courses are required. At least one of them must be at the three hundred level or above. Transfer students entering with 40-70 credits must take two writing emphasis courses and those entering with more than 70 credits must take one.
- Students are encouraged to take courses that meet multiple requirements, for example, courses that are both "W" and "J" courses.

Program Specific Notes:
> * Must be approved by advisor and may be an internship.

Colorful Mobius Strip
Courtesy of Dr. Jeremy Brazas

BSEd in Mathematics

Of all the baccalaureate degrees, the BSEd is the most subject to change because the Pennsylvania Department of Education can change the certification requirements at any time. Thus, it is essential that you regularly check with your advisor and the College of Education and Social Work web site (http://www.wcupa.edu/education-socialWork/) to learn of any changes.

During your first two years of study you will take the lower division, mathematics core courses and courses in professional education. No later than April of your first year you must begin the process of gaining the clearances required for the field work you will complete during your second year. These clearances must be renewed annually thereafter.

Clearances Required Prior to Participating in Early Field Experiences
Students are required to possess the original copy of the following:
    a) The Pennsylvania Child Abuse Clearance,
    b) The Pennsylvania State Police Criminal Record Check,
    c) FBI Background Fingerprint Check, and
    d) Verification of a negative reading on a TB test.

See the following web page for further information:
        http://www.wcupa.edu/education-socialWork/clearances.aspx

During the middle of your second year, you must begin the process of seeking Formal Admission to Teacher Education (FATE). All students seeking a B.S.Ed. must formally apply for admission to teacher education. Only those students formally admitted to teacher education will be eligible to enroll in MAT 350, MAT 360, MAT 354, and MAT 364.

Formal Admission to Teacher Education (FATE)
The requirements for Formal Admission to Teacher Education include:
    a) Earned a minimum of 48 credits at the college level (100 level or above)
    b) Earned a minimum cumulative GPA of 2.8
    c) Earned 3 credits in college-level English composition
    d) Earned 3 credits in literature taught in English
    e) Earned 6 credits in college-level mathematics
    f) Achieved passing scores as established by the PA Department of Education on the SAT, ACT Plus Writing, or Core Academic Skills for Educators or Pre-service Academic Performance Assessment (PAPA) test modules.
    g) Approval of the Department of Mathematics and College of Education.

Because these requirements are subject to change, be sure to check http://www.wcupa.edu/education-socialWork/fate.aspx for the current requirements.

Fall 2018/Spring 2019 B.S.Ed. Mathematics– 124 credits

GENERAL EDUCATION REQUIREMENTS (48 LESS 18 ATTRIBUTED TO MAJOR REQUIREMENTS = 30 CREDITS)		
	CREDITS	SEMESTER
WRT 120	3	
WRT 200, 204, 205, 206, 208, or 220	3	
MATHEMATICS (MAT 311)	3	
SPK 208 OR 230	3	
DIVERSE COMMUNITIES "J" COURSE (LAN/ ENG 382 below)	3	
INTERDISCIPLINARY "I" COURSE	3	
SCIENCE (3 CREDITS OF PHY 170 below)	3	
SCIENCE (CSC 141 below)	3	
BEHAVIOR & SOCIAL SCI (PSY 100 recommended)	3	
BEHAVIOR & SOCIAL SCI (ANT, SOC, ECO, GEO, OR PSC)	3	
HUMANITIES (HIS 444 below)	3	
HUMANITIES (LIT OR CLS -- REQUIRED FOR FATE)	3	
ARTS (ART, CINEMATOGRAPHY, MUSIC ,PHOTOGRAPHY, THEATRE)	3	
GENERAL EDUCATION ELECTIVE (MAT 125 RECOMMENDED)	3	
GENERAL EDUCATION ELECTIVE	3	
GENERAL EDUCATION ELECTIVE	3	
WRITING INTENSIVE COURSES: MAT 350, MAT 354, MAT 401		
NOTE TO STUDENTS AND ADVISORS: I COURSES MAY NOT COUNT AS DISTRIBUTIVE REQUIREMENTS.		
PROFESSIONAL EDUCATION REQUIREMENTS (34 CREDITS)		
HIS 444 History of Education	3	
EDA 103 Foundations of Special Education	3	
EDA 304 Special Education Process & Procedures[1]	3	
EDR 347 Literacy Development and Secondary Students with Disabilities in Inclusive Classrooms	3	
LAN/ ENG 382 Teaching English Language Learners (ELLs) PK-12 – "J"	3	
EDP 250 Educational Psychology[1]	3	
MAT 350 Middle School Mathematics Methods[1] "W"	3	
MAT 360 Middle School Mathematics Field Experiences [1,2]	1	
EDS 411 Student Teaching[1]	6	
EDS 412 Student Teaching[1]	6	

MATHEMATICS COURSES (49 credits)		
	CREDITS	SEMESTER
MAT 161 Calculus II	4	
MAT 162 Calculus II	4	
MAT 200 Nature of Mathematics	3	
MAT 261 Calculus III	4	
MAT 311 Linear Algebra	3	
MAT 331 Geometry	3	
MAT 354 Secondary Mathematics Methods[3] "W"	3	
MAT 364 Secondary Mathematics Field Experiences	1	
MAT 401 History of Mathematics "W"	3	
MAT 411 Algebra I	3	
MAT 414 Number Theory	3	
MAT 421 Mathematical Statistics I	3	
MAT 441 Real Analysis I	3	
Applied Mathematics Elective	3	
Analysis Elective	3	
Mathematics Elective	3	
COGNATE REQUIREMENTS (11 credits)		
PHY 170 Physics I	4	
PHY 180 Physics II	4	
CSC 141 Intro Computer Science	3	

1 Clearances required.
2 To be taken concurrently with MAT 350
3 To be taken concurrently with MAT 364

For details of the program requirements below, refer the College of Education website.
- Basic Skills Requirements (Sophomore Year, Required for Formal Admission):
- Praxis 5161-Mathematics Content Knowledge Test (Must take prior to student teaching)

B.S.Ed. Mathematics
Sample Course Plan
Students Admitted
Fall 2018/Spring 2019

Year	Fall	Spring
1	MAT 125 MAT 161 WRT 120 SPK 208 or 230 Gen Ed Humanities LIT	MAT 162 MAT 200 WRT 200, 204, 205, 206, 208 or 220 Gen Ed Behavioral/ Social Science CSC 141
2	MAT 261 MAT 311 PHY 170 EDA 103 EDP 250[1]	MAT 441 MAT Analysis Elective[2] PHY 180 EDA 304[1] PSY 100
3	MAT 411 MAT 421 MAT 350 "W" (Required) MAT 360[1] (Required) HIS 444 Gen Ed Elective	MAT 331 MAT 414 MAT 354 "W" (Required) MAT 364[1] (Required) LAN/ ENG 382 "J" EDR 347
4	EDS 411[1] & 412[1]	MAT Applied Mathematics Elective[2] MAT Elective [2] "I" Course Gen Ed Arts MAT 401 "W"

General Notes:
- Three writing-emphasis (W) courses are required. At least one of them must be at the three hundred level or above. Transfer students entering with 40-70 credits must take two writing emphasis courses and those entering with more than 70 credits must take one.
- Students are encouraged to take courses that meet multiple requirements, for example, courses that are both "I" and "J" courses.

Program Specific Notes:
1. Clearances required.
2. The table that lists courses by area (e.g., algebra, analysis, applied mathematics) is given on page 30.

Minor Programs

Minor in Mathematics

Required Courses (15 credits)

    MAT 161 Calculus I (4)
    MAT 162 Calculus II (4)
    MAT 261 Calculus III (4)
    MAT 311 Linear Algebra (3)

Approved Electives (6 credits)

    Any two courses in mathematics with course numbers above 311 with the exception of those courses with a primary focus on teacher education or those courses restricted to students majoring in elementary education.

In this minor, a student must earn a minimum grade of C- in each course and have an average of at least 2.0 over all the courses taken in the minor.

Minor in Mathematics: Grades PreK-8

Required Courses

    MAT 101 Mathematics for Teachers of Children I (3)
    MAT 102 Mathematics for Teachers of Children II (3)
    MAT 121 Statistics (3)
    MAT 312 Algebra for Teachers in Grades 4-8 (3)
    MAT 313 Geometry for Teachers in Grades 4-8 (3)
    MAT 351 Methods for Teaching Children Mathematics (3)
    MAT 353 Methods for Teaching Middle School Mathematics (3)
    MAT 390 Seminar in Mathematics Education (3)

In this minor, a student must earn a minimum grade of C- in each course and have an average of at least 2.0 over all the courses taken in the minor.

Minor in Applied Statistics
Required Courses
Complete one of the following calculus courses: (3 or 4)
      MAT 143   Brief Calculus (3)
      MAT 145   Calculus for the Life Sciences (3)
      MAT 161   Calculus I (4)

Complete one of the following courses:
      MAT 125   Introduction to Statistics I
      ECO   251   Quantitative Business Analysis I

Complete the following course:
      MAT 122   Introduction to Statistics II

Complete at least one of the following:
      STA   311   Intro Statistical Computing and Data Management (3)
      STA   319   Applied Statistics (3)
      STA   320   Experimental Design (3)
      MAT 421   Mathematical Statistics I (3)

Elective Courses
Select from the following courses as necessary to complete a total of 18 credits:
      BIO 310 Biostatistical Applications
      CSC 241 Data Structures & Algorithms
      CSC 321 Data Base Management Systems
      ECO 252 Quantitative Business Analysis II
      ECO 401 Introduction to Econometrics
      GEO 326 Geographical Analysis
      HEA 419 Research Methods in Health
      MAT 421 Mathematical Statistics I
      MIS 300 Introduction to Management Information Systems
      MKT 360 Marketing Research
      PPD 481 Drug Design I
      PSY 245 Statistics for the Behavioral Sciences
      PSY 246 Research Methods in Psychology
      STA 311 Intro Statistical Computing and Data Management
      STA 319 Applied Statistics
      STA 320 Experimental Design

In this minor, a student must earn a minimum grade of C- in each course and have an average of at least 2.0 overall the courses taken in the minor

Calendar of Planned Course Offerings

Developmental, 100, and 200 Level Courses				
Course	**Semester or Session Offered**			
	Fall	**Spring**	**Summer**	**Winter**
MAT Q20	√	√	√	
MAT Q30	√	√	√	
MAT 101	√	√	√	
MAT 102	√	√	√	
MAT 103	√	√	√	√
MAT 104	√	√	√	
MAT 113	√	√	√	
MAT 115	√	√		
MAT 121	√	√	√	√
MAT 125	√			
MAT 131	√	√	√	
MAT 143	√	√	√	
MAT 145	√	√		
MAT 151	√	√	√	
MAT 161	√	√	√	
MAT 162	√	√	√	
MAT 200	√	√	√	
MAT 261	√	√	√	
STA 200	√	√		

300-400 Level Courses				
Course	**Semester Offered***			
	Fall Even Numbered Years	**Spring Odd Numbered Years**	**Fall Odd Numbered Years**	**Spring Even Numbered Years**
MAT 311§	√	√	√	√
MAT 312	√	√	√	√
MAT 313	√	√	√	√
MAT 321			√	
MAT 325		√		√
MAT 331		√		√
MAT 343	√	√	√	√
MAT 350	√		√	
MAT 351	√	√	√	√

§Also offered in Summer.

300-400 Level Courses				
	Semester Offered*			
Course	**Fall Even Numbered Years**	**Spring Odd Numbered Years**	**Fall Odd Numbered Years**	**Spring Even Numbered Years**
MAT 352†		√		√
MAT 353†	√	√	√	√
MAT 354		√		√
MAT 360	√		√	
MAT 364		√		√
MAT 371	√	√	√	√
MAT 390	√	√	√	√
MAT 401	√	√	√	√
MAT 411	√		√	
MAT 412		√		√
MAT 413	√		√	
MAT 414		√		√
MAT 415		√		
MAT 421	√	√	√	√
MAT 422		√		√
MAT 423	√		√	
MAT 425	√		√	
MAT 427	√			
MAT 432		√		
MAT 441	√	√	√	√
MAT 442	√		√	
MAT 443		√		√
MAT 445	√		√	
MAT 478		√		√
MAT 479		√		√
MAT 493			√	
STA 201	√			
STA 202			√	
STA 311	√	√	√	√
STA 319	√	√	√	√
STA 320	√		√	
STA 321		√		√
STA 490	√		√	

*If there is sufficient demand, 300-400 level courses will be offered during the summer.
†MAT 352 and MAT 353 are offered during a special session from mid-May to mid-June.

Placement of Electives in Groups

Algebra	Analysis	Applied Mathematics
MAT 321 Combinatorics MAT 412 Algebra II MAT 414 Number Theory *MAT 415 Introduction to Cryptography§§*	MAT 343 *Differential Equations*** MAT 362 Calculus IV MAT 432 Topology MAT 442 Real Analysis II MAT 443 Applied Analysis I MAT 444 Applied Analysis II MAT 445 Complex Variables	MAT 325 Computational Mathematics *MAT 343 Differential Equations*** MAT 371 Mathematics of Finance MAT 413 Computer Algebra *MAT 415 Introduction to Cryptography§§* MAT 422 Mathematical Statistics II MAT 423 Applied Probability MAT 425 Numerical Analysis MAT 427 Optimization MAT 478 Fundamentals of Actuarial Science MAT 479 Financial Calculus MAT 493 Modeling STA 319 Applied Statistics

MAT 343 **cannot be credited to both areas.
§§MAT 415 **cannot** be credited to both areas.

Other Upper-Division Electives:

> MAT 332 Differential Geometry
> MAT 381 Discrete Mathematics
> MAT 401 History of Mathematics
> MAT 405 Special Topics in Mathematics
> MAT 432 Topology
> MAT 490 Seminar in Mathematics

Note: Mathematics courses designed for education majors or as general education courses may not count as mathematics electives, namely, MAT 301, MAT 302, MAT 309, MAT 312, MAT 313, MAT 330, MAT 350, MAT 351, MAT 352, MAT 353, MAT 354, MAT 357, MAT 360, MAT 364, and MAT 390.

Special Opportunities for Undergraduates

Accelerated, 3 + 2 Graduate Programs

The Department offers four accelerated, 3+2 graduate programs for capable and motivated students. These programs allow students to complete their baccalaureate and Master's degree in five years comprised of three years of undergraduate study followed by two years of graduate study. Accelerated programs are offered in:

- Mathematics B.A. to M.A. in Mathematics Accelerated Program
- Mathematics B.S. - Applied and Computational Mathematics Concentration to M.S. in Applied and Computational Mathematics Accelerated Program
- Mathematics B.S. - Mathematics Concentration to M.A. in Mathematics Accelerated Program
- Mathematics B.S. - Statistics Concentration to M.S. in Applied Statistics Accelerated Program

For program requirements and sample course plans see:
http://catalog.wcupa.edu/general-information/index-course-prefix-guide/program-index/

Actuarial Science Recognition

Most students in the Actuarial Science program take preliminary exams of the Society of Actuaries (SOA). Our courses prepare students fully for the Probability (P) exam, the Financial Mathematics (FM) exam, and the Statistics of Risk Modeling* (SRM) exams. In addition, we have several courses that contain material to prepare students for both the Short- and Long- Term Actuarial Mathematics* (STAM and LTAM) exams, the Financial Markets (IFM) exam and the Predictive Analytics* (PA) exam. We also have courses which will earn students Validation by Educational Experience (VEE) credit from the SOA. As an incentive for passing an actuarial exam, our students receive the *Actuarial Recognition Award*, a $100 cash award, and recognition at our Annual Awards Banquet. (*These are new exams of the SOA and will be offered for the first time after July 2018.)

BSEd - International Opportunities for Student Teaching

The College of Education currently is developing opportunities for prospective secondary mathematics teachers to complete a portion of their student teaching at international partner schools where the medium of instruction is English. Interested students should contact the College of Education during Spring Semester of their sophomore year to learn more about these opportunities.

Cayman Islands Summer Experience

Actuarial Science and Mathematical Finance majors can enroll in summer courses at the University College of the Cayman Islands. Students take either HIS 120, Caymanian Society, or HIS 121, Survey of Caribbean History, both of which count as Diversity "J" courses and for their second course students select one of

ENG 231 Business Communication – [Transfers as ENG 368]
ACC 121 Introduction to Accounting – [Transfers as ACC 201]
ECO 221 Principles of Microeconomics – [Transfers as ECO 111]
ECO 222 Principles of Macroeconomics – [Transfers as ECO 112]

Research Experiences for Undergraduates (REU)

Summer research programs for undergraduate mathematics students are available at various sites across the country. These are particularly valuable for students who are considering graduate school, and the summer following the junior year is an ideal time to participate. Application deadlines typically fall in February or March, and most programs provide a stipend. More information about specific programs is available from the American Mathematical Society at http://www.ams.org/programs/students/emp-reu and the National Science Foundation at https://www.nsf.gov/crssprgm/reu/.

Recommended Preparation for Graduate Study

Recommended Mathematics Courses

The following courses are recommended for students intending to enter a graduate program in pure or applied mathematics:

MAT 343 Differential Equations
MAT 412 Algebra II
MAT 414 Theory of Numbers
MAT 421 Mathematical Statistics I
MAT 422 Mathematical Statistics II
MAT 432 Topology
MAT 442 Real Analysis II (or MAT 444 Applied Analysis II)
MAT 445 Complex Variables

Recommended Computer Science Courses

Mathematics and statistics majors generally are encouraged to take courses in computer science. The following courses are recommended.

CSC 141 Computer Science I
CSC 142 Computer Science II
CSC 240 Computer Science III
CSC 241 Data Structures & Algorithms
CSC 321 Database Management Systems

General Department Information

Advanced Placement Credit

The University's policy for granting credit is as follows:

AP Course	AP Grade	Credits Awarded	Credit Given For
Calculus AB	3	3	MAT 143 (Formerly MAT 108) or MAT 145 (for BIO majors)
Calculus AB	4, 5	4	MAT 161

Calculus BC
   Calculus AB Sub-score
   Calculus BC Score
	
	4, 5
	4, 5
		
		4
		4
			
			MAT 161
			MAT 162

Statistics	3	3	MAT 121
Statistics	4, 5	3	MAT 125

Computer Labs

The Mathematics Department has two computer labs, UNA 103 and UNA 109. These computers have all of the mathematics software needed for classes. Mathematics majors can obtain access to these labs Monday through Friday 8 a.m.-10 p.m.

Independent Study

Qualified students may take a course on an independent study basis. This alternative is appropriate when a student has a specialized and compelling interest that cannot be pursued within the framework of a regular course. A GPA of at least 2.00 both overall and within the student's major are required. Independent Study Forms may be obtained from the Registrar's Office web page.

Individualized Instruction

Individualized instruction is the teaching of a regular, listed catalog course to a single student. Individualized instruction is offered only when the University has cancelled or failed to offer a course according to schedule. The Individualized Instruction Form is available from the Registrar's Office web page.

Mathematics Colloquia

Almost every Wednesday afternoon, the Department of Mathematics hosts a talk on an important topic in mathematics or mathematics education. The talks are presented by our faculty, visiting faculty members, well known lecturers in mathematics education, former students, and sometimes even current upper-class undergraduate or graduate students.

Pi Mu Epsilon

Pi Mu Epsilon is a national mathematics honor society. Induction is by invitation based on mathematics GPA.

Social Activities
There are frequent opportunities for faculty and students to socialize. Both are invited to attend the Wednesday afternoon Teas and the Annual Awards Banquet as well other events sponsored by individual faculty members and student organizations.

Tutoring
When you need help, you should first visit your professor during his/her office hours. These office hours are posted on the bulletin boards throughout 25 University Avenue and on the instructor's course syllabus.

Free tutoring, dependent on funding by the Dean's Office, also usually is available to mathematics students. The tutors often are undergraduate or graduate mathematics majors. The tutoring hours are posted on the door of room 105 of 25 University Avenue and also on the bulletin boards throughout the mathematics building

University Avenue Mathematics Club (formally Anderson Math Club)
The University Avenue Mathematics Club is open for all Mathematics and Mathematics education majors to join. Meeting times are posted on bulletin boards of 25 University Avenue. The Club exists to help promote social and academic activities for our majors. Activities include: speakers on careers in mathematics; an open forum with current student teachers; visits to schools or to regional mathematics or mathematics education activities; the annual Thanksgiving Dinner, in which 25 UNA Mathematics Club students prepare a Potluck dinner for current and retired mathematics and mathematics education faculty.

The Department's Scholarship/Award Programs

A number of scholarships are supported by departmental alumni, former faculty members, and friends of the Department.

The Mathematics Scholarship (1974)
The Mathematics Scholarship was created in 1974 by the faculty of the Department of Mathematical Sciences. The initial purpose was to raise funds for an endowment that would generate enough interest to provide several monetary awards to undergraduate majors of the department for their high academic achievements.

Class of '43 Scholarship (1991)
Two class members of the Class of 1943, Jean Stevenson and Oreste Leto established this fund in celebration of their 50th Class Reunion.

Mark Weiner Memorial Scholarship (1992)
Mark Wiener was a Professor of Mathematics, Mathematics Education, and Computer Education at West Chester University. He was the sponsor of the Anderson Math Club and was President of the Association of Teachers of Mathematics of Philadelphia and Vicinity (ATMOPAV).

Michael P. Montemuro Memorial Scholarship (1998)
Dr. Michael P. Montemuro, who served as Chair of the Department of Mathematics and Professor of Mathematics, was a member of the University faculty for 34 years. He was very active in the faculty union and served as president of ASPCUF for 18 years. Dr. Montemuro received the Distinguished APSCUF Service Award, the West Chester University Presidential Service Award, and was coach of the University ski team.

Dr. and Mrs. Albert E. Filano Mathematics Scholarship (2000)
Dr. Albert E. Filano was a long-serving faculty member and administrator, serving the University for more than 35 years as Professor of Mathematics, Department Chair, Division Director, Academic Vice President, Interim President and advisor to the Newman Center. The scholarship fund was established as part of the naming of Filano Hall dedicated on August 19, 2000, the couple's 50th wedding anniversary.

Benjamin E. Faber Endowed Scholarship (2002)
This scholarship was created by George and Karin Faber, parents of Benjamin, after his death in an automobile accident on October 30, 2001, when a deer struck his car. Ben was a 1996 graduate of Unionville High School. He received an associate degree with honors from Delaware County Community College and was a senior at West Chester University pursuing both mathematics and physics. Ben was also a member of Phi Theta Kappa national honor fraternity. Ben earned the rank of Eagle Scout while a member of Troop 22.

Applied Statistics Endowment (2008)
The Applied Statistics Graduate Degree Program was created in Fall of 2003 and this fund was created to provide an award to graduate students in the Program who have shown exceptional academic achievement in their studies.

Frank Milliman Endowed Scholarship (2008)
For 48 years Professor Frank Milliman taught, mentored, and advised thousands of West Chester University students. Among his former students, one can easily find university professors, professional mathematicians, actuaries, and literally hundreds of current secondary school mathematics teachers who constantly tell us how they strive to teach mathematics, to assess student achievement (with high standards), and to be available for students the way Professor Milliman was for them. Professor Milliman's name will always be synonymous with the Department of Mathematics.

Mary Pinder Nunan '43 Endowed Scholarship (2015)
When Mary Pinder was a junior at West Chester State Teachers College she won a mathematics award for excellence. This event, in the spring of 1942, had a great impact on Mary and she always knew that one day she would create her own scholarship for West Chester mathematics majors. In the spring of her senior year, her dean asked her if she would be willing to substitute teach math at Pierre S. du Pont High School in Delaware. Mary accepted the position and took the bus from outside (Old) Main Hall to Delaware every day to teach. In May, Mary attended her West Chester graduation and returned to du Pont Monday, as its school year did not end until mid-June. She graduated with the highest honors and three majors: mathematics, English, and social studies.

Actuarial Science Award Fund (2016)
Established by the Department of Mathematics, the purpose of this fund is twofold: (a) to reimburse, either partially or fully, those West Chester students who have passed one of the actuarial examinations offered by the Society of Actuaries, Casualty Actuarial Society, or other certifying organization; and (b) to recognize excellence in actuarial science.

Class of 1963 Scholarship for Promising Math Education Majors (2016)
Jim Rubillo credits Albert E. Filano and Frank Milliman for recognizing and supporting students who demonstrated promise in mathematics education. After graduating in 1963, Jim embarked on a 47 year career in public education. He remained active within several mathematics professional associations at the state and national levels and provided teacher professional development programs in fifty states and across Canada. Most recently, Jim served as the Executive Director of the National Council of Teachers of Mathematics (NCTM) for eight years. Jim received the Ross Taylor/Glenn Gilbert National Leadership Award of the National Council of Supervisors of Mathematics, and the NCTM Lifetime Achievement Award for Distinguished Service to Mathematics Education. Jim also received the University's Distinguished Alumni Award and an honorary Doctor of Science degree. This scholarship awards a math education senior who demonstrates leadership and excellence in mathematics education courses.

Grosshans Hirsch Applied Mathematics Endowment (2016)
Dr. Michael Hirsch graduated in 1996 with a Bachelor of Arts in Mathematics and Computer Science. He later attained a Masters in Applied Mathematics from the University of Delaware and a Doctor of Philosophy in Operations Research from the University of Florida. Dr. Hirsch credits Dr. Frank Grosshans, an accomplished West

Chester University faculty member and mathematician, for introducing him to the government defense field, where he has spent over 20 years developing solutions for both defense and commercial problems. Today, Michael is the owner and President of ISEA TEK (Industrial & Systems Engineering Analysis Technologies). This scholarship recognizes a mathematics major who demonstrates potential and excellence in several core mathematics courses.

Katherine Smith Math Endowment (2016)

Katherine Smith graduated from West Chester University in 2011 with a Bachelor of Science in Mathematics Education. Katherine's father, Richard, and mother, Patricia who is a 1977 West Chester University alumna, established this scholarship in honor of their daughter. This scholarship recognizes a student majoring in mathematics who demonstrates high academic achievement in the view of mathematics faculty.

M.S. Applied Statistics Fund (2016)

Established following the generous contribution of alumna. April Taylor M'11, this fund offers support for programming, speakers or events that enhance the experience of students and alumni of the Applied Statistics Graduate Program.

James L'heureux Scholarship (2017)

Dr. James L'heureux joined the faculty of West Chester State College in 1969. In 1974, Professors L'heureux, Branton, Morgan, and Verno raised $112 from selling books, which marked the beginning of the Mathematics Scholarship Fund. Under the leadership of Dr. L'heureux, this fund grew to over $100,000 by his retirement in 2000 and today it has a balance of well over $640,000. In addition to the Mathematics Scholarship Fund, Dr. L'heureux also encouraged friends of the Department to establish other scholarship funds for our students. The L'heureux Endowment was established by colleagues of Dr. L'heureux in recognition of and gratitude for all he has done for the Department and our students.

The Department of Mathematics Scholarship Program was founded in 1974 by Dr. James L'heureux and he has served as its treasurer since that time.   All the above scholarships and awards are given annually at an awards banquet held each fall. The banquet is attended by faculty, award recipients, friends, and family members.

There are also numerous scholarships and awards sponsored by the University. They are described in the *Undergraduate Catalog*.

Catalog Descriptions of Mathematics Courses

MAT Q20. Fundamental Skills in Arithmetic. 3 Credits.
This course is designed to strengthen basic arithmetic skills and to introduce the elements of algebra. Mathematics placement required. Credits earned in Q00-level courses do not count toward the 120 hours of credit needed for graduation.
Pre / Co requisites: MAT Q20 requires a prerequisite of an appropriate score on the Mathematics Placement Examination.
Typically offered in Fall, Spring & Summer.

MAT Q30. Fundamentals of Algebra. 3 Credits.
This course is designed to strengthen basic algebraic skills. Credits earned in Q00-level courses do not count toward the 120 hours of credit needed for graduation.
Pre / Co requisites: MAT Q30 requires a grade of C- or better in MAT Q20 or an appropriate score on the Mathematics Placement Examination.
Typically offered in Fall, Spring & Summer.

MAT 101. Mathematics for Teachers of Children I. 3 Credits.
Sets; functions; logic; development of whole numbers, integers, and rationals (including ratios, proportions, and percents); number theory; problem solving. For students seeking Certification in Grades PK-4 or 4-8 only.
Pre / Co requisites: MAT 101 requires a grade of C- or better in MAT Q30 or an appropriate score on the Mathematics Placement Examination.
Typically offered in Fall, Spring & Summer.

MAT 102. Mathematics for Teachers of Children II. 3 Credits.
Development of real numbers; geometry; measurement; probability and statistics; problem solving. For students seeking Certification in Grades PK-4 or 4-8 only.
Pre / Co requisites: MAT 102 requires prerequisite of MAT 101.
Typically offered in Fall, Spring & Summer.

MAT 103. Introduction to Mathematics. 3 Credits.
This course is a liberal arts introduction to the nature of mathematics. Topics are chosen from among logic, graph theory, number theory, symmetry (group theory), probability, statistics, infinite sets, geometry, game theory, and linear programming. These topics are independent of each other and have as prerequisite the ability to read, reason, and follow a logical argument.
Pre / Co requisites: MAT 103 requires prerequisites of a grade of C- or better in MAT Q30 or an appropriate score on the Mathematics Placement Examination.
Typically offered in Fall, Spring & Summer.

MAT 104. Introduction to Applied Mathematics. 3 Credits.
The course is designed to help prepare students to understand almost any quantitative issues they will encounter in contemporary society. Topics are selected from the following: principles of reasoning, problem-solving tools, financial management, exponential growth and decay, probability, putting statistics to work, mathematics and the arts, discrete mathematics in business and society and the power of numbers.
Pre / Co requisites: MAT 104 requires prerequisites of a grade of C- or better in MAT Q30 or an appropriate score on the Mathematics Placement Examination.
Typically offered in Fall, Spring & Summer.

MAT 113. Algebra and Functions. 3 Credits.
A review of basic algebra, followed by a thorough treatment of polynomial, rational, exponential, and logarithmic functions. Successful completion of this course prepares students for MAT 143.
Pre / Co requisites: MAT 113 requires a prerequisite of a grade of C- or better in MAT Q30 or an appropriate score on the Mathematics Placement Examination.
Typically offered in Fall, Spring & Summer.

MAT 115. Algebra, Functions, and Trigonometry. 3 Credits.
Topics include polynomial, rational, exponential, logarithmic, and trigonometric functions. An emphasis is placed on using technology to understand topics of importance in the life and earth sciences. Successful completion of this course prepares students for MAT 143 or MAT 145.
Pre / Co requisites: MAT 115 requires a grade of C- or better in MAT Q30 or an appropriate score on the Mathematics Placement Examination. Typically offered in Fall & Spring.

MAT 121. Introduction to Statistics I. 3 Credits.
Introduction to statistics and statistical inference. Concepts include: descriptive statistics, sampling distributions, confidence intervals, hypothesis testing, along with a formal introduction to linear regression and categorical data analysis. Statistical software including, but not limited to SPSS and Excel, will be used to facilitate the understanding of important statistical ideas and for the implementation of data analysis in many areas of application.
Pre / Co requisites: MAT 121 requires a prerequisite of a grade of C- or better in MAT Q30 or an appropriate score on the Mathematics Placement Examination.
Typically offered in Fall, Spring & Summer.

MAT 125. Introduction to Statistics and Probability. 3 Credits.
Introduction to probability, statistics, and statistical inference. Concepts include: descriptive statistics, probability, probability distributions, sampling distributions, confidence intervals, hypothesis testing, along with a formal introduction to linear regression and categorical data analysis. Statistical software, including but not limited to SPSS and Excel, will be used to facilitate the understanding of important statistical ideas and for the implementation of data analysis in many areas of application.
Pre / Co requisites: MAT 125 requires an appropriate score on the Mathematics Placement Exam. Typically offered in Fall & Spring.

MAT 131. Precalculus. 3 Credits.
Topics include polynomial, rational, exponential, logarithmic, and trigonometric functions. An emphasis is placed on understanding function properties and graphs without the use of technology. Successful completion of this course prepares students for MAT 161.
Pre / Co requisites: MAT 131 requires a prerequisite of a grade of C- or better in MAT Q30 or an appropriate score on the Mathematics Placement Examination.
Typically offered in Fall, Spring & Summer.

MAT 143. Brief Calculus. 3 Credits.
An intuitive approach to calculus with emphasis on conceptual understanding and applications to business. Topics include differentiation, curve-sketching, optimization, integration, and partial derivatives.
Pre / Co requisites: MAT 143 requires a prerequisite of a grade of C- or better in MAT 113, MAT 115, or MAT 131; or an appropriate score on the Mathematics Placement Examination.
Typically offered in Fall, Spring & Summer.

MAT 145. Calculus for the Life Sciences. 3 Credits.
An overview of differential and integral calculus, motivated through biological problems. Topics include mathematical modeling with functions, limits, continuity, differentiation, optimization, and integration. Graphing calculators are used as an aid in the application of calculus concepts and methods to realistic biological problems.
Pre / Co requisites: MAT 145 requires a prerequisite of a grade of C or better in MAT 115 or MAT 131; or an appropriate score on the Mathematics Placement Examination.
Typically offered in Fall & Spring.

MAT 151. Introduction to Discrete Mathematics. 3 Credits.
Set theory, Boolean logic, elementary combinatorics, proofs, simple graph theory, and simple probability.
Pre / Co requisites: MAT 151 requires a prerequisite of a grade of C- or better in MAT Q30 or an appropriate score on the Mathematics Placement Examination.
Typically offered in Fall, Spring & Summer.

MAT 161. Calculus I. 4 Credits.
Differential and integral calculus of real-valued functions of a single real variable with applications.
Pre / Co requisites: MAT 161 requires prerequisites of a C or better in MAT 131 or an appropriate score on the Mathematics Placement Examination.
Typically offered in Fall, Spring & Summer.

MAT 162. Calculus II. 4 Credits.
Continuation of MAT 161 including the study of series, methods of integration, transcendental functions, and applications to the sciences.
Pre / Co requisites: MAT 162 requires prerequisite of C or better in MAT 161.
Typically offered in Fall, Spring & Summer.

MAT 190. Topics in Mathematics. 3 Credits.
Topics announced at time of offering.
Consent: Permission of the Department required to add.

MAT 200. The Nature of Mathematics. 3 Credits.
Topics include the role of mathematics in contemporary society, career opportunities, mathematical notation and argument, structure of proofs, basic facts about logic, mathematical proofs, problem-solving techniques, and introductions to mathematical software packages.
Pre / Co requisites: MAT 200 requires a prerequisite of C or better in MAT 161. Course should be taken by the end of sophomore year.
Typically offered in Fall, Spring & Summer.

MAT 201. Elementary Functions Essential Calculus I. 3 Credits.
Elementary functions from an advanced viewpoint with detailed discussion of formal manipulations. Special emphasis on applications and the use of technology. Open only to prospective Grade 4-8 certification students.
Pre / Co requisites: MAT 201 requires prerequisite MAT 102.

MAT 202. Elementary Functions and Essential Calculus II. 3 Credits.
Elementary functions from an advanced viewpoint with detailed discussions of formal manipulations. Special emphasis on applications and the use of technology. Open only to prospective Grade 4-8 certification students.
Pre / Co requisites: MAT 202 requires prerequisite MAT 201.

MAT 203. Elementary Functions and Essential Calculus II. 3 Credits.
Continued discussion of elementary functions. Introduction to the intuitive ideas of derivative and integral with applications.
Pre / Co requisites: MAT 203 requires prerequisite of MAT 202.

MAT 261. Calculus III. 4 Credits.
The calculus of several variables. Topics include polar coordinates, vectors and three-dimensional analytic geometry, differentiation of functions of several variables, multiple integrals, and line and surface integrals.
Pre / Co requisites: MAT 261 requires a prerequisite of MAT 162 with a C or better.
Typically offered in Fall, Spring & Summer.

MAT 301. The Scientific Revolution. 3 Credits.
This course addresses how modern science began in the 17th century by examining its origins and including introductions to the heroes of science - Copernicus, Kepler, Galileo, and Newton.
Gen Ed Attribute: Interdisciplinary Requirement, Writing Emphasis.
Typically offered in Fall & Spring.

MAT 302. Mathematics and Social Justice. 3 Credits.
In this course we will explore several social issues and we will discuss methods which can quantitatively illustrate that are taking place. By doing so, the hope is that each student will learn mathematical skills and techniques. This tool kit of basic mathematical skills is often referred to as Quantitative Literacy (QL). Moreover as attainment of QL is itself a social justice issue, we will explore ways to carry these skills to historically marginalized groups through service learning projects.

MAT 309. Topics in Math for Elementary Teachers. 3 Credits.
Introduction to programming in BASIC; computer uses for the classroom teacher; descriptive statistics with applications for teaching; and measurements of length, area, volume, and temperature that focus on the SI metric system with practice in the classroom. Additional topics in applied mathematics will be considered.
Pre / Co requisites: MAT 309 requires prerequisite of MAT 102.
Repeatable for Credit.

MAT 311. Linear Algebra. 3 Credits.
An introduction to linear algebra. Topics covered include matrices, systems of linear equations, vector spaces, linear transformation, determinants, eigenvalues, spectral theorem, and triangulation.
Pre / Co requisites: MAT 311 requires Concurrent or Prerequisite of MAT 162.
Typically offered in Fall, Spring & Summer.

MAT 312. Algebra for Teachers in Grades 4-8. 3 Credits.
Formal structure of groups, rings, and fields with examples from the elementary curriculum. Topics from linear algebra including matrices, determinants, and linear programming.
Pre / Co requisites: MAT 312 requires prerequisite of MAT 102.
Typically offered in Fall & Spring.

MAT 313. Geometry for Teachers in Grades 4-8. 3 Credits.
Modern informal approach to two- and three-dimensional geometric figures, measurement, similarity, congruence, coordinate geometry, and the postulational method.
Pre / Co requisites: MAT 313 requires prerequisite of MAT 102.
Typically offered in Fall & Spring.

MAT 321. Combinatorics and Graph Theory. 3 Credits.
Introduction to set theory, graph theory, and combinatorial analysis. Includes relations, cardinality, elementary combinatorics, principles of inclusion and exclusion, recurrence relations, zero-one matrices, partitions, and Polya's Theorem.
Pre / Co requisites: MAT 321 requires prerequisites of C or better in MAT 162 and MAT 200.
Typically offered in Fall.

MAT 325. Numerical Analysis I. 3 Credits.
A basic introduction to numerical analysis and scientific computing. Topics which will be studied include: Computer arithmetic, approximation and interpolation of functions, numerical quadratures, solutions of linear systems by direct methods, numerical solutions of nonlinear scalar equations, numerical differentiation, introduction to one step methods for the numerical solution of ordinary differential equations.
Pre / Co requisites: MAT 325 requires a prerequisite of MAT 162 with a "C" or better.
Typically offered in Spring.

MAT 330. Using Technology Teaching Elementary School Mathematics. 3 Credits.
Using computer software, calculators, and the Internet as aids in teaching elementary school mathematics.
Pre / Co requisites: MAT 330 requires prerequisites of MAT 101 and MAT 102.
Typically offered in Fall & Spring.

MAT 331. Foundations of Geometry. 3 Credits.
Geometric foundations from an advanced viewpoint. Topics are chosen from euclidean and noneuclidean geometrics.
Pre / Co requisites: MAT 331 requires prerequisite of C or better in MAT 162.
Typically offered in Spring.

MAT 332. Differential Geometry. 3 Credits.
Classical differential geometry from a modern viewpoint. Curves and surfaces and shape operators. Introduction to Riemann geometry.
Pre / Co requisites: MAT 332 requires prerequisites of C or better in MAT 200, MAT 261 and MAT 331.

MAT 343. Differential Equations. 3 Credits.
The general theory of nth order, and linear differential equations including existence and uniqueness criteria and linearity of the solution space. General solution techniques for variable coefficient equations, series solutions for variable coefficient equations, and study of systems of linear equations.
Pre / Co requisites: MAT 343 requires a prerequisite of C or better in MAT 162 and MAT 311. Typically offered in Fall & Spring.

MAT 350. Techniques of Teaching Middle School Mathematics. 3 Credits.
This course focuses on effective, research-based techniques for teaching children mathematical concepts in middle school. Topics include building pedagogical content knowledge for lesson planning, questioning, formative assessment, and effective integration of technology. Additionally, building mathematical knowledge for teaching of specific topics is addressed in the areas of number sense, ratio, algebra, geometry, probability, and statistics.
Pre / Co requisites: MAT 350 requires prerequisites of MAT 261, EDA 304, Field Clearances, and Formal Admission to Teacher Education. MAT 350 requires a co-requisite of MAT 360.
Gen Ed Attribute: Writing Emphasis.   Typically offered in Fall

MAT 351. Methods for Teaching Children Math. 3 Credits.
Concepts, learning aids, syllabi, texts, and methods in elementary school mathematics.
Pre / Co requisites: MAT 351 requires prerequisites of MAT 101 and MAT 102.
Typically offered in Fall & Spring.

MAT 352. Methods for Teaching Children Mathematics II. 3 Credits.
Techniques for teaching children concepts such as geometry in two and three dimensions, number sentences, graphing, ratios and percentages, quantifiers, etc. Use of laboratory materials will be emphasized.
Pre / Co requisites: MAT 352 requires prerequisites of MAT 351, Field clearances and Formal Admission to Teacher Education.
Typically offered in Spring & Summer.

MAT 353. Methods for Teaching Middle School Mathematics. 3 Credits.
Techniques for teaching children mathematical concepts in the middle school standards. Topics covered include number, algebra, geometry, and probability and statistics.
Pre / Co requisites: MAT 353 requires prerequisites of MAT 121, MAT 312, MAT 313, MAT 351, field clearances, and FATE.
Typically offered in Fall, Spring & Summer.

MAT 354. Techniques of Teaching Secondary School Mathematics. 3 Credits.
This course focuses on effective, research-based techniques for teaching children mathematical concepts in secondary school. Topics include building pedagogical content knowledge for writing learning progressions, orchestrating discussion, formative assessment, developing high quality tasks, and effective integration of technology. Additionally, building mathematical knowledge or teaching for specific topics is addressed in the areas of geometry, algebra, discrete math, probability, statistics, trigonometry, and calculus.
Pre / Co requisites: MAT 354 requires prerequisites of MAT 350, field clearances, and Formal Admission to Teacher Education. MAT 354 requires a corequisite of MAT 364.
Gen Ed Attribute: Writing Emphasis. Typically offered in Spring.

MAT 357. Teaching Mathematics to Diverse Learners. 3 Credits.
Methods and materials associated with the presentation of mathematics to the handicapped. Emphasis on individualization and involving thinking skills at the concrete level. Evaluative and interpretive techniques are included.
Pre / Co requisites: MAT 357 requires prerequisites of MAT 101 and MAT 102 and formal admission into teacher education.

MAT 360. Field Experiences in Middle School Mathematics. 1 Credit.
The objective of this course is to apply the skills, techniques, and dispositions required to be an effective middle and secondary mathematics teacher. This course will allow you to work in a classroom setting to examine how the curriculum is delivered in a middle and high school setting. You will work with students on an individual or group basis, work cooperatively with teachers, and participate in the lesson and assessment planning process. By the end of the course, you should teach at least one lesson in a classroom setting.

Pre / Co requisites: [MAT 360](#) requires a prerequisite of Formal Admission to Teacher Education. [MAT 360](#) requires a co-requisite of [MAT 350](#).
Typically offered in Fall.

MAT 362. Calculus IV. 3 Credits.
The calculus of vector-valued functions of a vector variable. Derivatives and properties of the derivative including the chain rule, fields and conservative fields, integration, and Green's, Stokes', and Gauss' theorems.
Pre / Co requisites: [MAT 362](#) requires prerequisite of C or better in [MAT 261](#) and C or better in [MAT 311](#).

MAT 364. Field Experiences in Secondary School Mathematics. 1 Credit.
The objective of this course is to apply the skills, techniques, and dispositions required to be an effective secondary mathematics teacher. This course will allow you to work in a classroom setting to examine how the curriculum is delivered in a middle and high school setting. You will work with students on an individual or group basis, work cooperatively with teachers, and participate in the lesson and assessment planning process. By the end of the course, you should teach at least one lesson in a classroom setting.
Pre / Co requisites: [MAT 364](#) requires prerequisites of [MAT 360](#) and Formal Admission to Teacher Education. [MAT 364](#) requires a co-requisite of [MAT 354](#).
Typically offered in Spring.

MAT 371. Mathematics of Finance. 3 Credits.
The purpose of this course is to introduce the mathematical theory behind the concepts of: measurement of interest, annuities, yield rates, amortization of loans, sinking funds, and yield rates. Understanding the fundamental concepts of financial mathematics, and how these concepts can be applied to calculate present and future values of various financial instruments, is the prevailing theme of the course.
Pre / Co requisites: [MAT 371](#) requires prerequisite of [MAT 162](#) with a "C" or better.
Typically offered in Fall & Spring.

MAT 381. Discrete Mathematics. 4 Credits.
This course is designed to provide a foundation for the mathematics used in the theory and application of computer science. Topics include mathematical reasoning, the notion of proof, logic, sets, relations and functions, counting techniques, algorithmic analysis, modelling, cardinality, recursions and induction, graphs, and algebra.
Pre / Co requisites: [MAT 381](#) requires prerequisite of C or better in [MAT 162](#).

MAT 390. Seminar in Mathematics Education. 3 Credits.
This course is the capstone course for grades 4-8 certification students completing the 30-credit mathematics certification option. Topics selected from mathematics, statistics, the history of mathematics, and mathematics education for their significance and interest. Field experience may be required.
Pre / Co requisites: [MAT 390](#) requires prerequisite of Formal Admission to Teacher Education.
Typically offered in Fall & Spring.   Repeatable for Credit.

MAT 400. History of Mathematics for Elementary Teachers. 3 Credits.
History and development of elementary mathematics from primitive times to the discovery of calculus. Problems of the period are considered.
Pre / Co requisites: MAT 400 requires prerequisites of MAT 312 and MAT 313.

MAT 401. History of Mathematics. 3 Credits.
Development of mathematics from the Babylonian era to the 18th Century. Some modern topics included.
Pre / Co requisites: MAT 401 requires prerequisite of C or better in MAT 261.
Gen Ed Attribute: Writing Emphasis.
Typically offered in Fall & Spring
.

MAT 405. Special Topics in Mathematics. 3 Credits.
Topics announced at the time of offering.
Consent: Permission of the Department required to add.
Repeatable for Credit.

MAT 411. Algebra I. 3 Credits.
Abstract algebra. Algebraic systems, groups, rings, integral domains, and fields.
Pre / Co requisites: MAT 411 requires prerequisites of C or better MAT 200, MAT 261, and MAT 311.
Typically offered in Fall.

MAT 412. Algebra II. 3 Credits.
Abstract algebra. Algebraic systems, groups, rings, integral domains, and fields.
Pre / Co requisites: MAT 412 requires prerequisite of C or better in MAT 411.
Typically offered in Spring.

MAT 413. Computer Algebra. 3 Credits.
The focus of this course is to introduce students to computer algebra packages and review important topics in algebra, calculus and linear algebra.
Pre / Co requisites: MAT 413 requires prerequisites of MAT 162 and MAT 311 with a "C" or better.
Typically offered in Fall.

MAT 414. Theory of Numbers. 3 Credits.
Properties of integers; primes, factorization, congruences, and quadratic reciprocity.
Pre / Co requisites: MAT 414 requires prerequisites of C or better in MAT 200 and MAT 261.
Typically offered in Spring.

MAT 415. Introduction to Cryptography. 3 Credits.

An introduction to the mathematics behind various aspects of modern cryptography, including matrix cryptosystems, quadratic ciphers such as the Rabin cipher, exponential ciphers such as the Diffie-Hellman Key Exchange, the RSA algorithm and DES encryption.
Pre/Co requisites: MAT 415 requires prerequisites of MAT161 and MAT151 OR MAT161 and MAT 200
Typically offered in Spring.

MAT 421. Mathematical Statistics I. 3 Credits.

Probability; discrete distributions; continuous distributions; mathematical expectation; moment generating functions; bivariate distributions; distributions of functions of random variables. Use of appropriate technology.
Pre / Co requisites: MAT 421 requires a prerequisite of C or better in MAT 261 or a corequisite of MAT 261.
Typically offered in Fall & Spring.

MAT 422. Mathematical Statistics II. 3 Credits.

Order statistics; point estimation; interval estimation; tests of statistical hypotheses; statistics power; least squares regression. Use of appropriate technology.
Pre / Co requisites: MAT 422 requires prerequisite of C or better in MAT 421 and either MAT 121 or MAT 125.
Typically offered in Spring.

MAT 423. Applied Probability. 3 Credits.

Standard Concepts and methods of stochastic modeling and applications of stochastic processes.
Pre / Co requisites: MAT 423 requires prerequisites of MAT 261, MAT 311, and MAT 421 with a "C" or better.
Typically offered in Fall.

MAT 425. Numerical Analysis II. 3 Credits.

An examination of advanced topics in numerical analysis and scientific computing. Topics include: Approximation and interpolation of functions, numerical quadratures, matrix norms, iterative methods of numerical linear algebra, numerical solution of nonlinear systems of equations, and methods for the numerical solution of ordinary differential equations.
Pre / Co requisites: MAT 425 requires a prerequisite of C or better in MAT 325.
Typically offered in Fall.

MAT 427. Introduction to Optimization Techniques. 3 Credits.

Nature of optimization problems: deterministic and stochastic, and discrete and continuous. Computer methods of solution, systematic and random search, linear quadratic, dynamic programming, and others.
Pre / Co requisites: MAT 427 requires prerequisites of C or better in MAT 261 and C or better in MAT 311.
Typically offered in Fall.

MAT 432. Topology. 3 Credits.
Elements of point set topology. Separation axioms. Connectedness, compactness, and metrizability.
Pre / Co requisites: MAT 432 requires prerequisites of C or better
in MAT 200 and MAT 261.
Typically offered in Spring.

MAT 441. Real Analysis I. 3 Credits.
Introduces the real line, limits of sequences, Cauchy sequences, limits of real functions, continuous functions, intermediate value theorem, the derivative, mean value theorems and Riemann integral.
Pre / Co requisites: MAT 441 requires prerequisites of C or better
in MAT 200 and MAT 261.
Typically offered in Fall & Spring.

MAT 442. Real Analysis II. 3 Credits.
A continuation of MAT 441. Introduces infinite series, sequences and series of functions, Taylor's Theorem with applications and topics from integration theory.
Pre / Co requisites: MAT 442 requires prerequisite of C or better in MAT 441.
Typically offered in Fall.

MAT 443. Applied Analysis I. 3 Credits.
The techniques of analysis applied to problems in the physical sciences. Topics include partial differential equations, orthogonal functions, complex integration, and conformal mapping.
Pre / Co requisites: MAT 443 requires prerequisite of C or
better MAT 261, MAT 311 and MAT 343.
Typically offered in Spring.

MAT 444. Applied Analysis II. 3 Credits.
The techniques of analysis applied to problems in the physical sciences. Topics include partial differential equations, orthogonal functions, complex integration, and conformal mapping.
Pre / Co requisites: MAT 444 requires prerequisite of C or better in MAT 443.
MAT 445. Complex Variables. 3 Credits.

Introduction to functions of a complex variable. Analytic functions, mappings, differentiation and integration, power series, and conformal mappings.
Pre / Co requisites: MAT 445 requires prerequisite of C or better in MAT 261.
Typically offered in Fall.

MAT 455. Industrial Mathematics Practicum. 3 Credits.
This is a case study, team problem-solving based course focused on solving real-world problems that can be modeled using discrete or continuous mathematics techniques and which emanate from industry. Ideally, the problems would be obtained from partnerships with local industry. Until these relationships develop, extant problems or problems arising

in WCU faculty research (in math, physics, biology, geology, finance, etc.) will be used.
Pre / Co requisites: MAT 455 requires prerequisites of STA 319, MAT 425,
and MAT 413 and any one of MAT 493 or MAT 427.
Typically offered in Fall & Spring.
Repeatable for Credit.

MAT 478. Fundamentals of Actuarial Science. 3 Credits.

Students completing this course will have a better understanding of actuarial models of life contingencies, more specifically, students will understand that life insurance payments, life annuity payments, pension payments, etc. are determined by financial random variables dependent on human life.
Pre / Co requisites: MAT 478 requires prerequisite of MAT 371 and MAT 421 with a "C" or better.
Typically offered in Spring.

MAT 479. Financial Calculus. 3 Credits.

This course aims to provide the undergraduate mathematics major with an introduction to the mathematics behind derivative pricing and portfolio management. Pricing theory is first developed through the typical binomial model and then is extended to continuous time via the Black-Scholes model. In addition, the student will be exposed to how arbitrage can be used to aid in the pricing more complicated derivatives, such as call options on dividend-paying securities and exotic options.
Pre / Co requisites: MAT 479 requires prerequisite of MAT 371 and MAT 421 with a "C" or better.
Typically offered in Spring.

MAT 491. Internship in Applied Mathematics. 2-4 Credits.

In cooperation with regional businesses and industrial companies, student will perform an internship in applied mathematics.
Repeatable for Credit.

MAT 493. Mathematical Modeling. 3 Credits.

The idea of a mathematical model of a real situation. Techniques and rationales of model building. Examples from the life, physical, and social sciences.
Pre / Co requisites: MAT 493 requires prerequisites of C or better in MAT 261 and C or better in MAT 343.
Typically offered in Fall.

MAT 499. Independent Study in Mathematics. 1-3 Credits.

Independent investigation of an area of mathematics not covered in the department's course offerings.
Consent: Permission of the Department required to add.
Repeatable for Credit.

STA 200. Introduction to Statistics II. 3 Credits.

Continuation of MAT 121/MAT 125. Inference about the means, standard deviations and proportions, goodness of fit, analysis of variance, regression analysis, correlation, and nonparametric tests.

Pre / Co requisites: STA 200 requires a prerequisite of a grade of C- or better in MAT 121, MAT 125 or ECO 251.

Typically offered in Fall & Spring.

STA 201. Statistical Methods for Political Polling. 3 Credits.

The purpose of this course is to introduce students to the statistical methodology used in the analysis of data from a political survey. Topics will include sampling techniques, hypothesis testing, sample size calculation, categorical data analysis, simple linear regression, and ANOVA. There will be a field trip to the Center for Opinion Research at Franklin and Marshall College at the beginning of the semester.

Pre / Co requisites: STA 201 requires prerequisites of MAT 121 and PSC 200.

Typically offered in Fall.

STA 202. Sports Analysis. 3 Credits.

In this course we will apply concepts such as regression, classification, clustering, decision trees and others to evaluate players and teams from baseball, basketball, football, hockey and soccer. We will also introduce the statistical programming language R in order to analyze recent (and large!) data sets.

Pre / Co requisites: STA 202 requires a prerequisite of a C- or higher in MAT 121 and MAT 125, or ECO 251.

Typically offered in Fall.

STA 311. Intro Statistical Computing and Data Management. 3 Credits.

Course will give students the ability to manage and manipulate data effectively, conduct basic statistical analysis, and generate reports and graphics primarily using the SAS Statistical Software Program.

Pre / Co requisites: STA 311 requires a prerequisite of MAT 121 or MAT 125.

Typically offered in Fall & Spring.

STA 319. Applied Statistics. 3 Credits.

This course will cover simple and multiple linear regression methods and linear time series analysis with an emphasis on fitting suitable models to data and testing and evaluating models against data.

Pre / Co requisites: STA 319 requires a prerequisite of C or better in (MAT 121 or MAT 125) and (MAT 143or MAT 145 or MAT 161).

Typically offered in Fall & Spring.

STA 320. Experimental Design. 3 Credits.

The purpose of this course is to guide students in learning how to design, conduct and analyze the results of scientific studies so that valid and objective inferences about the population are obtained. It will cover ANOVAs, block, factorial, and split plot designs, as well as response surface analysis.

Pre / Co requisites: STA 320 requires a prerequisite of C or better in MAT 121 or MAT 125.
Typically offered in Fall.

STA 321. Topics in Advanced Statistics. 3 Credits.
Course will cover select topics in categorical analysis, nonparametrics and time series analysis. Emphasis will be placed on statistical programming, particularly simulations.
Pre / Co requisites: STA 321 requires prerequisites of C or better
in STA 311, STA 319, STA 320, and MAT 421.
Typically offered in Spring.

STA 419. Basics of Statistical Learning. 3 Credits.
This course will provide an introduction to statistical learning and predictive modeling.
Tools will be developed for visualizing and understanding complex data sets. All data analysis will be done using the statistical programming language R.
Pre / Co requisites: STA 419 requires a prerequisite of a C or better in STA 319.
Typically offered in Fall.

STA 490. Capstone Course in Statistics. 3 Credits.
Course will synthesize lessons learned throughout the students career with the goal of preparing students for work as professional statisticians. Topics will include report writing, presentations, statistical consulting, sampling design, and resume writing.
Pre / Co requisites: STA 490 requires prerequisites of ENG 368 or ENG 375 or ENG 371 and a C or better in STA 320 and STA 321.
Typically offered in Fall.

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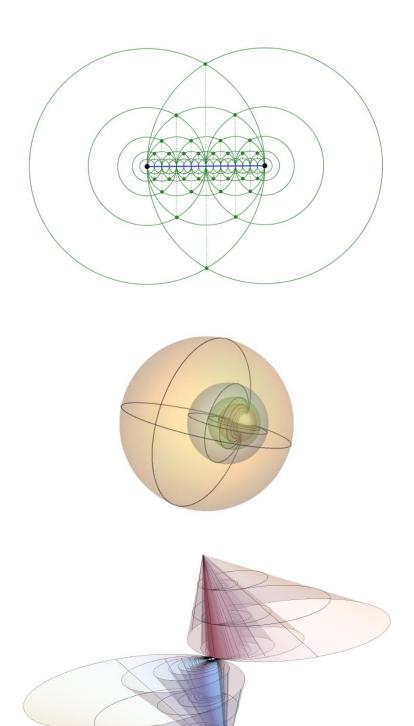
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Back Cover Art courtesy of Dr. Jeremy Brazas

Top: Ruler and compass construction of the dyadic rationals
Middle: 2 dimensional Hawaiian earring space
Bottom: Griffith's twin cone