

Department of Mathematics and Statistics

Dr. David C. Carothers, Head

Phone: (540) 568-6184

Location: Roop Hall, Room 305

E-mail: carothdc@jmu.edu

Web site: www.math.jmu.edu

Professors

D. Carothers, R. Domangue, C. Droms, S. Garren, J. Hanson, J. Klippert, P. Kohn, R. Lee, J. Liu, C. Lubert, G. Parker, G. Peterson, D. Pruett, J. Sochacki, L. Van Wyk, D. Warne

Associate Professors

E. Brown, J. Fitzgerald, H. Hamdan, S. Lucas, J. Marafino, J. Rosenhouse, L. Taalman, A. Tongen, D. Walton, P. Warne

Assistant Professors

E. Arnold, L. Chen, R. Field, N. Jahan, J. Kidd, C. Martin, J. Martin, K. Nashimoto, S. Prins, D. Sharma, R. Thelwell, L. Xu

Instructors

A. Casiple, R. Charest, F. Ford, J. Phillippi, E. Ruffin, C. Watson

Mission Statement

The Department of Mathematics and Statistics provides a program of study in the mathematical sciences which meets the needs of a wide variety of students and makes a continuing contribution to the advancement of mathematical and statistical knowledge and its dissemination. The program provides opportunities for in-depth study that can lead to careers as mathematicians and statisticians in private and public sectors, teachers of mathematics, and further study in graduate school. The program provides support for the mathematical and statistical needs of students in the natural sciences, integrated sciences, social sciences, and professional and pre-professional programs. The program meets the general education needs of all students, providing an understanding of mathematical and statistical thinking and approaches to problem solving. We are committed to promoting mathematics and statistics as an art of human endeavor as well as a fundamental method of inquiry into the sciences and a vast array of other disciplines. We are committed to encouraging an attitude of appreciation and support for mathematics and statistics in current university students and, through them, the next generation of citizens. We are also committed to fostering an appreciation for the effective use of applied mathematics and statistics in connection with and support of other disciplines for those students majoring in other subjects.

Goals

As a major in mathematics or statistics, a student can expect to use and build on skills such as:

- Thinking critically
- Formulating and solving problems
- Communicating solutions clearly, both orally and in writing

These skills have been gained in previous courses in mathematics, statistics and other areas. As the breadth of knowledge of the subject grows, students gain an increased understanding and appreciation of the fact that mathematics is truly a universal

language whose creation and applications cut across all boundaries of race, class, culture and time. There also will be opportunities for students to experience the challenge and rewards of faculty-mentored research, individually or as a member of a team, as they investigate mathematical and statistical problems that extend beyond those normally encountered in the classroom. Students increase their abilities to prove theorems, understand complex structures and apply mathematics and statistics in many real-world settings. The program students choose will make it possible for them to acquire strong preparation for graduate work or for professional applications in mathematics and statistics, teaching, natural and social sciences or other technical areas.

Programs

The Department of Mathematics and Statistics offers the B.A. and B.S. degrees with a major in mathematics and the B.S. degree with a major in statistics. There is a program for a major in mathematics that qualifies a student for initial teaching licensure. A concentration in computational sciences is also available. Minors are offered in mathematics and statistics.

The department also recognizes the importance of providing courses for non-specialists who need to make effective use of mathematics or statistics in their chosen careers.

The university is an institutional/educational member of the American Mathematical Society, the American Statistical Association, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics.

Students are strongly encouraged to participate in the numerous undergraduate research opportunities as well as individual and small group projects available in the department. Opportunities exist through the Center for Mathematical Modeling, the Office of Statistical Services, honors theses and independent studies with individual faculty mentors.

Majors in the department are expected to participate in assessment activities. Assessment information is used to assist faculty members in modifying curricula.

Degree and Major Requirements

Bachelor of Arts in Mathematics

Degree Requirements

Required Courses	Credit Hours
General Education ^{1,2}	41
Foreign Language classes (intermediate level required)	0-14
Philosophy course (in addition to General Education)	3
University electives	21-35
Major requirements (listed below)	41
	<hr/> 120

1 MATH 231 or MATH 235 must be included and students seeking secondary teaching licensure must include GPSYC 160.

2 The General Education program contains a set of requirements each student must fulfill. The number of credit hours necessary to fulfill these requirements may vary.

Bachelor of Science in Mathematics

Degree Requirements

Required Courses	Credit Hours
General Education ^{1,2}	41
Scientific Literacy requirement (in addition to General Education)	3-4
University electives	34-35
Major requirements (listed below)	41
	<hr/> 120

1 MATH 231 or MATH 235 must be included and students seeking secondary teaching licensure must include GPSYC 160.

2 The General Education program contains a set of requirements each student must fulfill. The number of credit hours necessary to fulfill these requirements may vary.

Major Requirements

Mathematics requirements depend on whether or not the student is seeking secondary teaching licensure. All students must complete 29 credit hours of the following required core mathematics courses and 12 credit hours of mathematics courses beyond the core.

Core Courses Required of All Majors	Credit Hours
MATH 236-237. Calculus II-III	8
MATH 238. Linear Algebra with Differential Equations	4
MATH 245. Discrete Mathematics	3
MATH 248. Computers and Numerical Algorithms	4
MATH 318. Introduction to Probability and Statistics	4
MATH 410. Advanced Calculus I	3
MATH 430. Abstract Algebra I	3
	<hr/> 29

Additional Requirements for Students Seeking Secondary Teaching Licensure

Students seeking secondary teaching licensure must (in addition to the required core courses):

- Complete the 22-24 credit hours which comprise the pre-professional (undergraduate) education program in secondary education.
- Complete 12 credit hours of mathematics courses as follows:
 - One of MATH 310 or MATH 315
 - MATH 415
 - MATH 475
 - One mathematics elective course numbered 310 or above

It is suggested that students with expectations of teaching AP Calculus take MATH 411 and those with expectations of teaching AP Statistics take either MATH 321 or MATH 322 for the above mathematics elective.

Students seeking secondary teaching licensure earn the Bachelor of Arts or Bachelor of Sciences degree and then complete the Master of Arts in Teaching degree. It is necessary to be admitted to the teacher education program prior to enrolling in pre-professional education courses. For a full description of the program in secondary education, refer to the College of Education, Department of Middle, Secondary and Mathematics Education.

Additional Requirements for Students Not Seeking Secondary Teaching Licensure

Students not seeking secondary teaching licensure track must (in addition to the required core courses) complete one of the following options, each consisting of 12 credit hours of mathematics courses:

- One of MATH 411, MATH 431 or MATH 435, and nine hours of mathematics electives numbered 310 or above.
- One of the pairs of courses MATH 426 and 427, MATH 440 and 441, or MATH 448 and 449, and six hours of mathematics electives numbered 310 or above.

The option chosen and the courses chosen to satisfy an option by a student are made in consultation with the student's adviser and are dependent upon the student's interests and career objectives. Students interested in pursuing graduate studies in mathematics are strongly urged to complete both MATH 411 and MATH 431.

Recommended Schedule for Majors

Seeking Secondary Licensure

First Year	Credit Hours
Skills for the 21st Century (Cluster One)	9-12
MATH 235-236. Calculus I-II	8
MATH 245. Discrete Mathematics	3
General Education courses	6-9
	<hr/> 30

Second Year	Credit Hours
MATH 237. Calculus III	4
MATH 238. Linear Algebra with Differential Equations	4
MATH 248. Computers and Numerical Algorithms	4
MATH 318. Introduction to Probability and Statistics	4
Pre-professional education requirements	6
General Education courses/electives	8
	<hr/> 30

Third Year	Credit Hours
MATH 430. Abstract Algebra I	3
Choose two of the following:	6

- MATH 310. Elementary Theory of Numbers
- MATH 315. The Real Number System
- MATH 410. Advanced Calculus I
- MATH 415. History of Mathematics
- MATH 475. Fundamental Concepts of Geometry
- Mathematics electives numbered 310 or above

Pre-professional education requirements and General Education courses/electives	21
	<hr/> 30

Fourth Year	Credit Hours
Choose three from the following:	9

- MATH 310. Elementary Theory of Numbers
- MATH 315. The Real Number System
- MATH 410. Advanced Calculus I
- MATH 415. History of Mathematics
- MATH 475. Fundamental Concepts of Geometry
- Mathematics elective(s) numbered at or above MATH 310

Pre-professional education requirements and General Education courses/electives	21
	<hr/> 30

Recommended Schedule for Majors Not Seeking Secondary Licensure

	Credit Hours
First Year	
Skills for the 21st Century (Cluster One)	9-12
MATH 235-236. Calculus I-II	8
MATH 245. Discrete Mathematics	3
General Education courses	6-9
	<hr/> 30

	Credit Hours
Second Year	
MATH 237. Calculus III	4
MATH 238. Linear Algebra with Differential Equations	4
MATH 248. Computers and Numerical Algorithms	4
MATH 318. Introduction to Probability and Statistics	4
General Education courses/electives	14
	<hr/> 30

	Credit Hours
Third Year	
Choose one of the following:	3
MATH 410. Advanced Calculus I	
MATH 430. Abstract Algebra I	
General Education courses/electives	18-21
Mathematics required or elective courses numbered 310 or above	6-9
	<hr/> 30

	Credit Hours
Fourth Year	
Choose one of the following:	3
MATH 410. Advanced Calculus I	
MATH 430. Abstract Algebra I	
Mathematics required or elective courses numbered 310 or above	6-9
Electives	18-21
	<hr/> 30

Computational Sciences Concentration

For students majoring in mathematics or physics, the Departments of Mathematics and Physics offer a coordinated sequence of courses that prepare students for careers in the rapidly expanding field of computer modeling of complex systems. This program is structured so that students can earn a major in one department and a minor in the other. Students need not decide on a major field until their junior year.

The computational sciences concentration will prepare students to design and use computer models in any of those areas in which applied mathematics is used to understand complex systems (meteorology, astronomy, geology/geophysics, oceanography, physics, etc.). The preparation is appropriate for both those students who plan to enter the work force after graduation and those who plan to enter graduate school in applied mathematics, physics, or one of the other fields mentioned above.

Students should complete the following courses during the first two years of the program:

MATH 235-237. Calculus I-III
MATH 248. Computers and Numerical Algorithms
MATH 336. Elementary Differential Equations, or
MATH 238. Linear Algebra with Differential Equations
PHYS 140L-150L. General Physics Laboratory I-II

PHYS 240-260. University Physics I-III
MATH/PHYS 265. Introduction to Fluid Mechanics

During their junior and senior years, students will normally complete the necessary course work for their major and minor. Mathematics majors will take PHYS 340, Mechanics, and MATH/PHYS 365, Introduction to Computational Fluid Mechanics, counted as a physics course to complete their physics minor. Physics majors will take MATH/PHYS 365 counted as a mathematics course and either MATH 337, Methods of Applied Calculus, or MATH 440, Fourier Analysis and Partial Differential Equations, to complete their mathematics minor. Seniors in either major must complete at least one topics or independent study/research course that involves computer modeling.

Bachelor of Science in Statistics

The Department of Mathematics and Statistics offers a major in statistics to meet the needs of both the public and the private sectors for graduates with degrees in statistics. The program has two tracks, Applied Statistics and Mathematical Statistics, one of which must be chosen by each student completing the major.

Students interested in the applications of statistics and planning to seek immediate employment as practicing statisticians upon graduation are advised to choose the **Applied Statistics** track. Emphasis in this track is on the applications of statistics to various fields of study. Students in this track will take courses on the design and analysis of experiments, regression analysis and sample surveys, as well as other courses in applied and theoretical statistics, probability and mathematics. Students who choose the applied statistics track are encouraged to take as many elective courses as possible in applied fields of their choice.

The **Mathematical Statistics** track is designed for students who have an interest in the mathematics of statistics or plan to go to graduate school in statistics. Students in this track will see more emphasis on probability and the theory of statistics. These students will also have a chance to take additional courses in applied and theoretical statistics as well as courses in mathematics. Students in this track are recommended to take elective courses from the statistics and mathematics courses offered by the department that will prepare them for graduate studies.

Students of statistics are advised to choose between the two tracks by the end of their sophomore year. However, there are a large number of courses common to both tracks, so students may be able to change tracks later in their academic career with little loss of time.

Bachelor of Science in Statistics:

Applied Statistics Track Degree Requirements

Required Courses	
General Education ^{1,2}	41
Scientific Literacy requirement (in addition to General Education)	3-4
University electives	29-33
Major requirements (listed below)	43-46
	<hr/> 120

¹ MATH 235 or MATH 231 must be included.

² The General Education program contains a set of requirements each student must fulfill. The number of credit hours necessary to fulfill these requirements may vary.

Major Requirements

Minimum requirements for a B.S. degree with a major in statistics, applied statistics track, are 47 credit hours in statistics and cognate mathematics courses which must include one of the electives in statistics listed below:

	Credit Hours
Statistics Courses	29-31
MATH 220. Elementary Statistics ¹	3
MATH 280. SAS Programming and Data Management	3
MATH 318. Introduction to Probability and Statistics	4
MATH 321. Analysis of Variance and Experimental Design	3
MATH 322. Applied Linear Regression	3
MATH 324. Applied Nonparametric Statistics	3
MATH 325. Survey Sampling Methods	3
MATH 421. Applied Multivariate Statistical Analysis	3
MATH 426. Probability and Mathematical Statistics I	3
MATH 429. Research Project in Statistics	1-3
Choose one of the following electives in statistics:	3
MATH 327. Categorical Data Analysis	
MATH 328. Time Series Analysis	
MATH 423. Stochastic Processes	
MATH 424. Statistical Decision Theory	
MATH 427. Probability and Mathematical Statistics II	
Mathematics Cognates:	11-12
MATH 236-237. Calculus II-III	8
MATH 300. Linear Algebra ²	3-4

¹ Waived for those who have "C" or better in MATH 318. No additional course will be required to substitute for MATH 220 in this program.

² MATH 238. Linear Algebra with Differential Equations may be substituted.

In addition to elective statistics courses offered by the department, students in this track are strongly recommended to take as many elective courses as possible from fields of application such as management, business administration, economics, biology or health sciences in which they are interested and in which they might like to be employed.

Recommended Schedule for Statistics Major, Applied Statistics Track

First Year	Credit Hours
Skills for the 21st Century (Cluster One)	9
MATH 220. Elementary Statistics	3
MATH 280. SAS Programming and Data Management	3
MATH 235. Calculus I	4
General Education courses	11
	<hr/> 30

Second Year	Credit Hours
MATH 236-237. Calculus II-III	8
MATH 318. Introduction to Probability and Statistics	4
MATH 325. Survey Sampling Methods	3
General education courses/electives	15
	<hr/> 30

Third Year	Credit Hours
MATH 321. Analysis of Variance and Experimental Design	3
MATH 322. Applied Linear Regression	3
MATH 324. Applied Nonparametric Statistics	3
MATH 300. Linear Algebra	3
MATH 426. Probability and Mathematical Statistics I	3
General education courses/electives	15
	<hr/> 30

Fourth Year	Credit Hours
MATH 421. Applied Multivariate Statistical Analysis	3
MATH 429. Research Projects in Statistics	1-3
Elective in Statistics	3
Electives	21-23
	<hr/> 30

Bachelor of Science in Statistics: Mathematical Statistics Track Degree Requirements

General Education ^{1,2}	41
Scientific Literacy requirement (in addition to General Education)	3-4
University electives	26-28
Major requirements (listed below)	48-49
	<hr/> 120

¹ MATH 235 or MATH 231 must be included.

² The General Education program contains a set of requirements each student must fulfill. The number of credit hours necessary to fulfill these requirements may vary.

Major Requirements

Minimum requirements for a B.S. degree with a major in statistics, mathematical statistics track, are 52 credit hours in statistics and cognate mathematics courses:

	Credit Hours
Statistics Courses:	28
MATH 220. Elementary Statistics ¹	3
MATH 280. SAS Programming and Data Management	3
MATH 318. Introduction to Probability and Statistics	4
MATH 321. Analysis of Variance and Experimental Design	3
MATH 322. Applied Linear Regression	3
MATH 324. Applied Nonparametric Statistics	3
MATH 421. Applied Multivariate Statistical Analysis	3
MATH 426-427. Probability and Mathematical Statistics I-II	6
Choose one of the following electives in statistics:	3
MATH 328. Time Series Analysis	
MATH 423. Stochastic Processes	
MATH 424. Statistical Decision Theory	
Mathematics Cognates:	17-18
MATH 236-237. Calculus II-III	8
MATH 245. Discrete Mathematics	3
MATH 300. Linear Algebra ²	3-4
MATH 410. Advanced Calculus I	3

¹ Waived for those who have "C" or better in MATH 318. No additional course will be required to substitute for MATH 220 in this program. ² MATH 238. Linear Algebra with Differential Equations, may be substituted.

In addition to elective statistics courses, students in this track are recommended to take elective courses from the mathematics courses offered by the department that will prepare them to continue in their studies toward an M.S. and/or a Ph.D. degree in statistics.

Recommended Schedule for Statistics Major, Mathematical Statistics Track

First Year	Credit Hours
Skills for the 21st Century (Cluster One)	9
MATH 220. Elementary Statistics	3
MATH 280. SAS Programming and Data Management	3
MATH 235. Calculus I	4
General education courses	11
	<hr/> 30

Second Year	Credit Hours
MATH 236-237. Calculus II-III	8
MATH 318. Introduction to Probability and Statistics	4
MATH 321. Analysis of Variance and Experimental Design	3
General education courses/electives	15
	<hr/> 30

Third Year	Credit Hours
MATH 322. Applied Linear Regression	3
MATH 300. Linear Algebra ¹	3
MATH 312. Discrete Mathematics	3
MATH 426-427. Probability and Mathematical Statistics I-II	6
General education courses/electives	15
	<hr/> 30

Fourth Year	Credit Hours
MATH 324. Applied Nonparametric Statistics	3
MATH 421. Applied Multivariate Statistical Analysis	3
MATH 410. Advanced Calculus I	3
Elective in Statistics	3
Electives	18
	<hr/> 30

¹ MATH 238, Linear Algebra with Differential Equations, may be substituted.

Minor Requirements

Mathematics Minor

The mathematics minor is open to students not majoring in mathematics or statistics. Each student must obtain **prior** approval of all courses to be counted in the minor from the mathematics adviser, Dr. Peter D. Kohn, or from the department head.

A minor in mathematics requires a minimum of 18 credit hours. At least six hours must be earned within the JMU Department of Mathematics and Statistics.

	Credit Hours
MATH 235-236. Calculus I-II or MATH 232 and MATH 236	8
Mathematics courses numbered 237 or above, excluding mathematics courses numbered 301-309	10
	<hr/> 18

Statistics Minor

The minor in statistics is open to any student not majoring in mathematics or statistics. Each student must obtain **prior** approval of the courses to be counted in the minor from the statistics minor adviser, Dr. Nusrat Jahan.

A minor in statistics requires a minimum of 18 credit hours.

	Credit Hours
MATH 322. Applied Linear Regression	3
Choose one of the following:	3-4
MATH 220. Elementary Statistics	
MATH 318. Introduction to Probability and Statistics or equivalent	
Choose four of the following:	12
MATH 280. SAS Programming and Data Management	
MATH 321. Analysis of Variance and Experimental Design	
MATH 324. Applied Nonparametric Statistics	
MATH 325. Survey Sampling Methods	
MATH 326. Statistical Quality Control	
MATH 327. Categorical Data Analysis	
MATH 328. Time Series Analysis	
MATH 421. Applied Multivariate Statistical Analysis	
MATH 423. Stochastic Processes	
MATH 424. Statistical Decision Theory	
MATH 426. Probability and Mathematical Statistics I	
MATH 427. Probability and Mathematical Statistics II	
	<hr/> 18-19

Credit by Examination

The Department of Mathematics offers credit by examination for some of the courses taught in the department. Students who want to take an examination must apply to the department head. Upon application students will receive details regarding approval to take the examination.