The Department of Mathematics offers curricula which lead to the following undergraduate degrees: Bachelor of Science in Applied Mathematical Sciences, Bachelor of Arts in Mathematics and Bachelor of Science in Mathematics. An Integrated Fast Track combined baccalaureate/graduate degree program is also offered.

The curriculum for the BS in Applied Mathematical Sciences includes courses in economics, industrial engineering, statistics, computer science and mathematics. A student completing this program is prepared to enter employment with analytical and quantitative tools relevant to modern technological industries and/or modern financial markets. On the other hand, with the appropriate electives chosen, the student is prepared to enter quantitatively oriented graduate programs. Advising for this degree option is done through the Undergraduate Program Office in the Department of Mathematics.

With carefully chosen electives in education, any one of the above three degree plans can lead to teacher certification. Students interested in teacher certification may find the BA degree plan the most suitable since this degree plan offers the greatest flexibility for the inclusion of teacher certification courses.

Faculty

Allen, Angela J, Instructional Assistant Professor Mathematics MS, Texas A&M University, 2005
Anshelevich, Michael V, Professor Mathematics PhD, University of California, Berkeley, 2000
Aurispa, Benjamin, Instructional Assistant Professor Mathematics MS, Texas A&M University, 2006
Austin, Amy L, Instructional Assistant Professor Mathematics MS, Texas A&M University, 1994
Baskin, Dean R, Assistant Professor Mathematics PhD, Stanford University, 2010
Battle III, Guy A, Professor Mathematics PhD, Duke University, 1977
Baudier, Florent P, Instructional Assistant Professor Mathematics PhD, Universite De Besancon, 2010
Belmonte Jr, Arthur P, Instructional Assistant Professor Mathematics MS, Texas A&M University, 1986
Berkolaiko, Gregory, Professor Mathematics PhD, University of Bristol, 1997
Boas, Harold P, Professor Mathematics PhD, Massachusetts Institute of Technology, 1980
Bollinger, Kathryn L, Instructional Assistant Professor Mathematics MS, Texas A&M University, 1998
Bonito, Andrea, Professor Mathematics PhD, Ecole Polytechnique Federale de Lausanne, France, 2006
Borosh, Itshak, Senior Professor Mathematics PhD, Weizmann Institute of Science, 1966
Brannan, Michael P, Assistant Professor Mathematics PhD, Queen's University, 2012
Bridy, Andrew D, Instructional Associate Professor Mathematics PhD, University of Wisconsin - Madison, 2014
Cai, Yue, Visiting Assistant Professor Mathematics PhD, University of Kentucky, 2016
Carter, Tamara A, Instructional Assistant Professor Mathematics PhD, Texas A&M University, 2005
Chen, Goong, Professor Mathematics PhD, University of Wisconsin - Madison, 1977
Comech, Andrew, Associate Professor Mathematics PhD, Columbia University, 1997
Daripa, Prabir, Associate Professor Mathematics PhD, Brown University, 1985
Demlow, Alan R, Professor Mathematics PhD, Cornell University, 2002
Devore, Ronald A, Distinguished Professor Mathematics PhD, Ohio State University, 1967
Douglas, Ronald G, Distinguished Professor Mathematics PhD, Louisiana State University and A&M College, 1962
Dykema, Kenneth J, Professor Mathematics PhD, University of California, Berkeley, 1993
Efendiev, Yalchin R, Professor Mathematics PhD, California Institute of Technology, 1999
Epstein, Janice L, Instructional Associate Professor Mathematics
PHD, Texas A&M University, 1992

Erdelyi, Tamas, Professor Mathematics
PHD, University of Southern Carolina, 1989

Foucart, Simon, Associate Professor Mathematics
PHD, University of Cambridge, 2005

Fry, Erin K, Lecturer Mathematics
MS, University Of Illinois Urbana Champaign, 1990

Fulling, Stephen A, Professor Mathematics
PHD, Princeton University, 1972

Geller, Susan C, Professor Mathematics
PHD, Cornell University, 1975

Goswami, Souvik, Visiting Assistant Professor Mathematics
PHD, University of Alberta, 2015

Grigorchuk, Rostislav, Distinguished Professor Mathematics
PHD, Moscow State University of Lomomosov, 1986

Gu, Cong, Visiting Assistant Professor Mathematics
PHD, Texas A&M University, 2015

Guermont, Jean-Luc, Professor Mathematics
PHD, Sorbonne Universites, 1995

Gustafson, Robert A, Associate Professor Mathematics
PHD, Yale University, 1979

Hanin, Boris L, Assistant Professor Mathematics
PHD, Northwestern University, 2014

Harris, Isaac, Visiting Assistant Professor Mathematics
PHD, University of Deleaware, 2015

Hensley, Douglas A, Senior Professor Mathematics
PHD, University of Minnesota, 1974

Hester, Yvette C, Instructional Associate Professor Mathematics
PHD, Texas A&M University, 2000

Howard, Peter B, Professor Mathematics
PHD, Indiana University, 1998

Johnson, Maya E, Lecturer Mathematics
PHD, Texas A&M University, 2015

Johnson, William B, Distinguished Professor Mathematics
PHD, Iowa State University, 1969

Jung, Junehyuk, Assistant Professor Mathematics
PHD, Princeton University, 2013

Kahlig, Joseph E, Instructional Assistant Professor Mathematics
MS, Texas A&M University, 1994

Kerr, David G, Professor Mathematics
PHD, University of Toronto, 2001

Kilmer, Kendra R, Instructional Assistant Professor Mathematics
MS, Texas A&M University, 2003

Kim, Joung Dong, Instructional Assistant Professor Mathematics
PHD, State University of New York at Stony Brook, 2012

Klein, Gregory S, Instructional Assistant Professor Mathematics
MS, Texas A&M University, 1992

Kuchment, Peter, Distinguished Professor Mathematics
PHD, Kharkov State University, Russia, 1973

Lahodny Jr, Glenn E, Instructional Assistant Professor Mathematics
PHD, Texas Tech University, 2012

Landsberg, Joseph M, Professor Mathematics
PHD, Duke University, 1990

Larson, David R, Professor Mathematics
PHD, University of California - Berkeley, 1976

Lazarov, Raytcho D, Professor Mathematics
PHD, University of Moscow, Russia, 1972

Lee, Sang Rae, Lecturer Mathematics
PHD, University of Oklahoma, 2012

Lewis, Jennifer L, Senior Lecturer Mathematics
PHD, Ohio State University, 1980

Liao, Benben, Visiting Assistant Professor Mathematics
PHD, Institut de Mathematiques de Jussieu, 2014
Limafilho, Paulo C, Professor  
Mathematics  
PHD, State University of New York at Stony Brook, 1989

Lynch, Benjamin R, Lecturer  
Mathematics  
PHD, University of Tennessee, 2010

Lynch, Richard G, Visiting Assistant Professor  
Mathematics  
PHD, University of Missouri, 2016

Manuel, David J, Instructional Assistant Professor  
Mathematics  
MS, Texas A&M University, 1994

Masri, Mohamad R, Associate Professor  
Mathematics  
PHD, University of Texas at Austin, 2005

Matusevich, Laura F, Professor  
Mathematics  
PHD, University of California, Berkeley, 2002

Mogilevsky, Mila, Instructional Assistant Professor  
Mathematics  
PHD, Rostov State University USSR, 1976

Motakis, Pavlos, Visiting Assistant Professor  
Mathematics  
PHD, National Technical University of Athens, 2015

Narcowich, Francis J, Professor  
Mathematics  
PHD, Princeton University, 1972

Nekrashevych, Volodymyr, Professor  
Mathematics  
PHD, Taras Shevchenko National University, Russia, 1998

Onica, Constantin, Instructional Assistant Professor  
Mathematics  
PHD, Texas A&M University, 2005

Orchard, Patrick J, Lecturer  
Mathematics  
MS, Texas A&M University, 2015

Paouris, Grigoris, Professor  
Mathematics  
PHD, University of Crete, 2004

Papanikolas, Matthew A, Professor  
Mathematics  
PHD, Brown University, 1998

Pasciak, Joseph E, Professor  
Mathematics  
PHD, Cornell University, 1977

Pearlstein, Gregory J, Associate Professor  
Mathematics  
PHD, UNIVERSITY OF MASSACHUSETTS AT AMHERST, 1999

Pearlstein, Rosanna, Lecturer  
Mathematics  
PHD, University of Massachusetts Amherst, 1998

Petrova, Guergana P, Professor  
Mathematics  
PHD, University of Southern Carolina, 1999

Pisier, Gilles, Distinguished Professor  
Mathematics  
PHD, University of Paris, 1977

Pitts, Jon T, Professor  
Mathematics  
PHD, Princeton University, 1974

Plavnik, Julia Y, Visiting Assistant Professor  
Mathematics  
PHD, National University of Cordoba, 2013

Poltoratski, Alexei G, Professor  
Mathematics  
PHD, California Institute of Technology, 1995

Popov, Bojan D, Professor  
Mathematics  
PHD, University of Southern Carolina, 1999

Procaccia, Eviatar B, Assistant Professor  
Mathematics  
PHD, Weizmann Institute of Science, 2013

Rahm Jr, Robert S, Visiting Assistant Professor  
Mathematics  
PHD, Washington University in St. Louis, 2017

Ramsey, Heather L, Instructional Assistant Professor  
Mathematics  
MS, Texas A&M University, 2004

Reihani, Kamran, Instructional Assistant Professor  
Mathematics  
PHD, Tarbiat Modares University, 2005

Rojas, Joseph M, Professor  
Mathematics  
PHD, University of California, Berkeley, 1995

Roque-Sol, Marco A, Lecturer  
Mathematics  
PHD, Texas A&M University, 2006

Rowell, Eric C, Professor  
Mathematics  
PHD, University of California, San Diego, 2003

Rundell, William, Professor  
Mathematics  
PHD, Glasgow University, 1974

Schiellack Jr, Vincent, Associate Professor  
Mathematics  
PHD, University of Texas at Austin, 1982
Schlumprecht, Thomas B, Professor
Mathematics
PHD, Ludwig Maximilians Universitat, Germany, 1988

Schrader, Todd W, Lecturer
Mathematics
MS, Texas A&M University, 2016

Sengupta, Sinjini, Senior Lecturer
Mathematics
PHD, Florida State University, 2006

Shatalov, Oksana, Instructional Associate Professor
Mathematics
PHD, Technion - Israel Institute of Technology, 2001

Shiu, Anne J, Assistant Professor
Mathematics
PHD, University of California at Berkeley, 2010

Sivakumar, Natarajan, Associate Professor
Mathematics
PHD, University of Alberta, 1990

Smith, Roger R, Professor
Mathematics
PHD, University of Oxford, 1976

Sottile, Frank J, Professor
Mathematics
PHD, University of Chicago, 1994

Stiller, Peter F, Professor
Mathematics
PHD, Princeton University, 1977

Straube, Emil J, Professor
Mathematics
PHD, Swiss Federal Institute of Technology Zurich, 1983

Sunik, Zoran, Professor
Mathematics
PHD, Binghamton University, 2000

Taliaferro, Steven D, Associate Professor
Mathematics
PHD, Stanford University, 1976

Tang, Xiaoxian, Visiting Assistant Professor
Mathematics
PHD, Peking University, Beijing, China, 2014

Titi, Edriss S, Professor
Mathematics
PHD, Indiana University, Bloomington, 1986

Tomas, Ignacio, Visiting Assistant Professor
Mathematics
PHD, University of Maryland College Park, 2015

Tretkoff, Paula, Professor
Mathematics
PHD, University of Nottingham, 1985

Tucker-Drob, Robin D, Assistant Professor
Mathematics
PHD, California Institute of Technology, 2013

Ventura, Emanuele, Visiting Assistant Professor
Mathematics
PHD, Aalto University, 2017

Vorobets, Mariya, Instructional Assistant Professor
Mathematics
PHD, Lviv National University, 2004

Vorobets, Yaroslav, Associate Professor
Mathematics
PHD, Moscow Lomonosov State University, 1998

Wang, Kun, Lecturer
Mathematics
PHD, University of Puerto Rico, Rio Piedras, 2014

Ward, Joseph D, Professor
Mathematics
PHD, Indiana University, 1973

Whitfield, Jennifer G, Instructional Assistant Professor
Mathematics
MS, Texas A&M University, 2000

Witherspoon, Sarah J, Professor
Mathematics
PHD, University of Chicago, 1994

Xie, Zhizhang, Assistant Professor
Mathematics
PHD, The Ohio State University, 2011

Yan, Huafei, Professor
Mathematics
PHD, Massachusetts Institute of Technology, 1997

Yang, Tian, Assistant Professor
Mathematics
PHD, Rutgers University at New Brunswick, 2013

Yasskin, Philip B, Associate Professor
Mathematics
PHD, University of Maryland, 1979

Young, Matthew P, Professor
Mathematics
PHD, Rutgers University, 2004

Yu, Guoliang, Professor
Mathematics
PHD, State University Of New York At Stony Brook, 1991

Yu, Shilin, Visiting Assistant Professor
Mathematics
PHD, Pennsylvania State University, 2013

Zelenko, Igor, Associate Professor
Mathematics
PHD, Technion - Israel Institute of Technology, 2002
Zhang, Yuan, Visiting Assistant Professor
Mathematics
PHD, Duke University, 2015

Zhang, Zheng, Visiting Assistant Professor
Mathematics
PHD, Stony Brook University, 2014

Zhou, Jianxin, Professor
Mathematics
PHD, Pennsylvania State University, 1986

Majors

- Bachelor of Arts in Mathematics (http://catalog.tamu.edu/undergraduate/science/mathematics/ba)
- Bachelor of Arts in Mathematics and Master of Science in Mathematics, 5-Year Degree Program (http://catalog.tamu.edu/undergraduate/science/mathematics/ba-ms)
- Bachelor of Science in Mathematics (http://catalog.tamu.edu/undergraduate/science/mathematics/bs)
- Bachelor of Science in Mathematics and Master of Science in Mathematics, 5-Year Degree Program (http://catalog.tamu.edu/undergraduate/science/mathematics/bs-ms)
- Bachelor of Science in Applied Mathematical Sciences, Actuarial Emphasis (http://catalog.tamu.edu/undergraduate/science/mathematics/applied-mathematics-bs-actuarial-emphasis)
- Bachelor of Science in Applied Mathematical Sciences, Biological Science Emphasis (http://catalog.tamu.edu/undergraduate/science/mathematics/applied-mathematics-bs-biological-science-emphasis)
- Bachelor of Science in Applied Mathematical Sciences, Computational Emphasis (http://catalog.tamu.edu/undergraduate/science/mathematics/applied-mathematics-bs-computational-emphasis)
- Bachelor of Science in Applied Mathematical Sciences, Economics Emphasis (http://catalog.tamu.edu/undergraduate/science/mathematics/applied-mathematics-bs-economics-emphasis)
- Bachelor of Science in Applied Mathematical Sciences, Math Emphasis (http://catalog.tamu.edu/undergraduate/science/mathematics/applied-mathematics-bs-math-emphasis)
- Bachelor of Science in Applied Mathematical Sciences and Master of Science in Mathematics, 5-Year Degree Program (http://catalog.tamu.edu/undergraduate/science/mathematics/applied-mathematical-sciences-bs-ms)

Minors

- Mathematics Minor (http://catalog.tamu.edu/undergraduate/science/mathematics/minor)

Courses

MATH 102 Algebra
Credits 3. 3 Lecture Hours.
(MATH 1314, 1414) Algebra. Sets, structure of number system; absolute values, solution sets of linear and nonlinear equations, of systems of equations, and of inequalities; relations and functions, graphical representations, graphical representations, progressions, mathematical induction, determinants.

MATH 131 Mathematical Concepts—Calculus
Credits 3. 3 Lecture Hours.
Mathematical Concepts—Calculus. Limits and continuity; rates of change, slope; differentiation: the derivative, maxima and minima; integration: the definite and indefinite integral techniques; curve fitting. Only one of the following will satisfy the requirements for a degree: MATH 131, MATH 142, MATH 147, MATH 151 and MATH 171.
Prerequisites: High school algebra I and II and geometry.

MATH 140 Mathematics for Business and Social Sciences
Credits 3. 3 Lecture Hours.
(MATH 1324) Mathematics for Business and Social Sciences. Application of common algebraic functions, including polynomial, exponential, logarithmic and rational, to problems in business, economics and the social sciences; includes mathematics of finance, including simple and compound interest and annuities; systems of linear equations; matrices; linear programming; and probability, including expected value. Only one of the following will satisfy the requirements for a degree: MATH 140, MATH 141 and MATH 166.
Prerequisite: High school algebra I and II and geometry.

MATH 141 Finite Mathematics
Credits 3. 3 Lecture Hours.
Linear equations and applications; systems of linear equations, matrix algebra and applications, linear programming, probability and applications, statistics. Only one of the following will satisfy the requirements for a degree: MATH 140, MATH 141 and MATH 166.
Prerequisites: High school algebra I and II and geometry.

MATH 142 Business Calculus
Credits 3. 3 Lecture Hours.
(MATH 1325, MATH 1425) Business Calculus. Limits and continuity; techniques and applications of derivatives including curve sketching and optimization; techniques and applications of integrals; emphasis on applications in business, economics, and social sciences. Only one of the following will satisfy the requirements for a degree: MATH 131, MATH 142, MATH 147, MATH 151 and MATH 171.
Prerequisites: MATH 140 or equivalent or acceptable score on Texas A&M University math placement exam.

MATH 147 Calculus I for Biological Sciences
Credits 4. 3 Lecture Hours. 2 Lab Hours.
Introduction to differential calculus in a context that emphasizes applications in the biological sciences. Only one of the following will satisfy the requirements for a degree: MATH 131, MATH 142, MATH 147, MATH 151 and MATH 171.
Prerequisite: MATH 150 or equivalent or acceptable score on TAMU Math Placement Exam.
MATH 148 Calculus II for Biological Sciences
Credits 4. 3 Lecture Hours. 2 Lab Hours.
Introduction to integral calculus in a context that emphasizes applications in the biological sciences; ordinary differential equations and analytical geometry. Only one of the following will satisfy the requirements for a degree: MATH 148, MATH 152 and MATH 172.
Prerequisite: MATH 147, MATH 151 or approval of instructor.

MATH 150 Functions, Trigonometry and Linear Systems
Credits 4. 3 Lecture Hours. 2 Lab Hours.
(MATH 2412) Functions, Trigonometry and Linear Systems. Graphs, functions, college algebra and trigonometry, linear systems and vectors.

MATH 151 Engineering Mathematics I
Credits 4. 3 Lecture Hours. 2 Lab Hours.
(MATH 2413) Engineering Mathematics I. Rectangular coordinates, vectors, analytic geometry, functions, limits, derivatives of functions, applications, integration, computer algebra. MATH 171 designed to be a more demanding version of this course. Only one of the following will satisfy the requirements for a degree: MATH 131, MATH 142, MATH 147, MATH 151 and MATH 171.
Prerequisite: MATH 150 or equivalent or acceptable score on TAMU Math Placement Exam.

MATH 152 Engineering Mathematics II
Credits 4. 3 Lecture Hours. 2 Lab Hours.
(MATH 2414) Engineering Mathematics II. Differentiation and integration techniques and their applications (area, volumes, work), improper integrals, approximate integration, analytic geometry, vectors, infinite series, power series, Taylor series, computer algebra. MATH 172 designed to be a more demanding version of this course. Only one of the following will satisfy the requirements for a degree: MATH 148, MATH 152 and MATH 172.
Prerequisite: MATH 151 or equivalent.

MATH 161 Engineering Mathematics II
Credits 3. 3 Lecture Hours.
Differentiation and integration techniques and their applications (area, volumes, work), improper integrals, approximate integration, analytic geometry, vectors, infinite series, power series, Taylor series. MATH 172 designed to be a more demanding version of this course. Only one of the following will satisfy the requirements for a degree: MATH 148, MATH 152 and MATH 172.
Prerequisite: MATH 151 or equivalent.

MATH 166 Topics in Contemporary Mathematics II
Credits 3. 3 Lecture Hours.
(MATH 1332) Topics in Contemporary Mathematics II. Finite mathematics, matrices, probability and applications. Only one of the following will satisfy the requirements for a degree: MATH 140, MATH 141 and MATH 166.
Prerequisites: High school algebra I and II and geometry.

MATH 167 Explorations in Mathematics
Credits 3. 3 Lecture Hours.
Application of mathematics to topics of contemporary societal importance using quantitative methods; may include elements of management science (optimal routes, planning and scheduling), statistics (sampling/polling methods, analyzing data to make decisions), cryptography (codes used by stores, credit cards, internet security), fairness (apportionment, voting) patterns (symmetry, tessellations, fractals), world health.
Prerequisites: High school algebra I and II.
MATH 251 Engineering Mathematics III
Credits 3. 3 Lecture Hours.
Vector algebra, calculus of functions of several variables, partial derivatives, directional derivatives, gradient, multiple integration, line and surface integrals, Green's and Stokes' theorems. MATH 221 designed to be a more demanding version of this course. Only one of the following will satisfy the requirements for a degree: MATH 221, MATH 251 and MATH 253.
Prerequisite: MATH 148, MATH 152, or MATH 172.

MATH 253 Engineering Mathematics III
Credits 4. 3 Lecture Hours. 2 Lab Hours.
(MATH 2415) Engineering Mathematics III. Vector algebra; calculus of functions of several variables, partial derivatives, directional derivatives, gradient, multiple integration, line and surface integrals, Green's and Stokes' theorems, computer algebra. MATH 221 designed to be a more demanding version of this course. Only one of the following will satisfy the requirements for a degree: MATH 221, MATH 251 and MATH 253.
Prerequisite: MATH 148, MATH 152, or MATH 172.

MATH 281 Seminar in Mathematics
Credit 1. 1 Lecture Hour.
Designed to familiarize students with mathematics pertaining to real world applications in such areas as biology, signal processing, quantum computation and robotics. May be taken four times for credit.

MATH 285 Directed Studies
Credits 1 to 4. 1 to 4 Other Hours.
Special problems not covered by any other lower-division course in the curriculum; intended for freshman and sophomore students.
Prerequisite: Approval of department head.

MATH 289 Special Topics in...
Credits 1 to 4. 1 to 4 Lecture Hours.
Selected topics in an identified area of mathematics. May be repeated for credit.
Prerequisite: Approval of instructor.

MATH 301 Research
Credits 0 to 4. 0 to 4 Other Hours.
Research conducted under the direction of faculty member in mathematics. May be repeated 2 times for credit.
Prerequisites: Freshman or sophomore classification and approval of instructor.

MATH 302 Discrete Mathematics
Credits 3. 3 Lecture Hours.
Formal structures for describing data, algorithms and computing devices; theory and applications of sets, graphs and algebraic structures.
Prerequisite: MATH 148, MATH 152, or MATH 172.

MATH 304 Linear Algebra
Credits 3. 3 Lecture Hours.
Introductory course in linear algebra covering abstract ideas of vector space and linear transformation as well as models and applications of these concepts, such as systems of linear equations, matrices and determinants. MATH 323 designed to be a more demanding version of this course. Only one of the following will satisfy the requirements for a degree: MATH 304, MATH 309, MATH 311 and MATH 323.
Prerequisite: MATH 148, MATH 152, or MATH 172; junior or senior classification.

MATH 308 Differential Equations
Credits 3. 3 Lecture Hours.
Prerequisites: MATH 221, MATH 251, or MATH 253, or concurrent enrollment; knowledge of computer algebra system.

MATH 309 Linear Algebra for Differential Equations
Credits 3. 3 Lecture Hours.
Systems of linear equations, matrices, determinants, vector spaces, linear transformations, eigenvalues and eigenvectors, diagonalization, inner product spaces, orthogonal functions, separation of variables, Fourier series, Bessel functions. Only one of the following will satisfy the requirements for a degree: MATH 304, MATH 309, MATH 311 and MATH 323.
Prerequisites: MATH 221, MATH 251, or MATH 253; MATH 308 or concurrent enrollment; junior or senior classification or approval of instructor.

MATH 311 Topics in Applied Mathematics I
Credits 3. 3 Lecture Hours.
Systems of linear equations, matrices, determinants, vector spaces, linear transformations, eigenvalues and eigenvectors, diagonalization, inner product spaces, orthogonal functions; vector analysis, including gradient, divergence, curl, line and surface integrals, Gauss', Green's and Stokes' theorems. Only one of the following will satisfy the requirements for a degree: MATH 304, MATH 309, MATH 311 and MATH 323.
Prerequisites: MATH 221, MATH 251, or MATH 253; MATH 308 or concurrent enrollment; junior or senior classification or approval of instructor.

MATH 323 Linear Algebra
Credits 3. 3 Lecture Hours.
Linear equations and matrices; real vector spaces, linear transformations, eigenvalues and eigenvectors, diagonalization, inner products. Designed to include more theory and be more demanding than MATH 304. Only one of the following will satisfy the requirements for a degree: MATH 304, MATH 309, MATH 311 and MATH 323.
Prerequisites: MATH 148, MATH 152 or MATH 172; MATH 220; junior or senior classification or approval of instructor.

MATH 325 The Mathematics of Interest
Credits 3. 3 Lecture Hours.
The mathematical theory associated with interest; annuities; varying annuities; sinking funds and amortization; coupon bonds; valuation of noncallable bonds; yield to maturity; yield curve; spot rates and forward rates; internal rate of return; duration and convexity; portfolio immunization.
Prerequisites: MATH 142, MATH 147, MATH 151 or MATH 171.

MATH 365 Structure of Mathematics I
Credits 3. 3 Lecture Hours.
Informal logic, sets, relations, functions, whole numbers, numeration systems, binary operations, integers, elementary number theory, modular systems, rational numbers and the system of real numbers. Designed primarily for elementary teacher certification. Others must have consent of instructor.
Prerequisites: Must have completed University Core Curriculum mathematics requirements with a grade of C of better.
MATH 366 Structure of Mathematics II  
Credits 3. 3 Lecture Hours.  
Geometry, measurement and coordinate geometry. Designed primarily for elementary teacher certification. Others must have consent of instructor.  
Prerequisite: MATH 365 or equivalent with a grade of C or better.

MATH 367 Basic Concepts of Geometry  
Credits 3. 3 Lecture Hours.  
Formal development of geometry: finite [Euclidean and non-Euclidean]. Designed primarily for elementary mathematics teacher certification. Others must have consent of instructor.  
Prerequisite: MATH 366 or equivalent with a grade of C or better.

MATH 368 Introduction to Abstract Mathematical Structures  
Credits 3. 3 Lecture Hours.  
Mathematical proofs, sets, relations, functions, infinite cardinal numbers, algebraic structures, structure of the real line; designed primarily for elementary teacher certification.  
Prerequisite: MATH 366 or equivalent with a grade of C or better.

MATH 375 Intermediate Real Analysis  
Credits 3. 3 Lecture Hours.  
Development of the real numbers, limits, foundations and major theorems of calculus. Designed primarily for mathematics teacher certification. Others must have consent of instructor.  
Prerequisite: MATH 220 or equivalent.

MATH 376 Intermediate Abstract Algebra  
Credits 3. 3 Lecture Hours.  
Relations, functions, binary operators, rings, homomorphisms, integral domains and fields. Designed primarily for mathematics teacher certification. Others must have consent of instructor.  
Prerequisites: MATH 220 or MATH 302; MATH 304 or equivalent.

MATH 396 Communications in Mathematics  
Credit 1. 1 Lecture Hour.  
Electronic, written, and oral communications in mathematics.  
Prerequisites: MATH 220, junior or senior classification, and mathematics major.

MATH 401 Advanced Engineering Mathematics  
Credits 3. 3 Lecture Hours.  
Engineering mathematics including Perturbation Theory, Fourier series and partial differential equations. Designed primarily for engineering majors. Others must have consent of instructor.  
Prerequisite: MATH 308.

MATH 403 Mathematics and Technology  
Credits 3. 3 Lecture Hours.  
Mathematical problem-solving and communication through the use of various technologies (both hardware and software). Intended primarily, but not limited to, students working toward teacher certification.  
Prerequisite: MATH 367 or MATH 467 with a grade of C or better.

MATH 407 Complex Variables  
Credits 3. 3 Lecture Hours.  
Fundamental theory of analytic functions, including residues and their applications.  
Prerequisite: MATH 221, MATH 251, or MATH 253.

MATH 409 Advanced Calculus I  
Credits 3. 3 Lecture Hours.  
Axioms of the real number system; point set theory of R1; compactness, completeness and connectedness; continuity and uniform continuity; sequences, series; theory of Riemann integration.  
Prerequisites: MATH 220; MATH 221, MATH 251 or MATH 253.

MATH 410 Advanced Calculus II  
Credits 3. 3 Lecture Hours.  
Differential and integral calculus of functions defined on Rm including inverse and implicit function theorems and change of variable formulas for integration; uniform convergence.  
Prerequisites: MATH 304 or MATH 323; MATH 409.

MATH 411 Mathematical Probability  
Credits 3. 3 Lecture Hours.  
Probability spaces, discrete and continuous random variables, special distributions, joint distributions, expectations, law of large numbers, the central limit theorem.  
Prerequisite: MATH 221, MATH 251, or MATH 253.

MATH 412 Theory of Partial Differential Equations  
Credits 3. 3 Lecture Hours.  
Formulation and solution of partial differential equations of mathematical physics; Fourier series and transform methods, complex variable methods, methods of characteristics and first order equations.  
Prerequisite: MATH 308 or approval of instructor.

MATH 414 Fourier Series and Wavelets  
Credits 3. 3 Lecture Hours.  
Fourier series and wavelets with applications to data compression and signal processing.  
Prerequisite: MATH 304, MATH 309, MATH 311, or MATH 323.

MATH 415 Modern Algebra I  
Credits 3. 3 Lecture Hours.  
A study of groups, rings, fields with emphasis on the theoretical aspects and proofs.  
Prerequisite: MATH 220; MATH 304 or MATH 323.

MATH 416 Modern Algebra II  
Credits 3. 3 Lecture Hours.  
Continuation of topics introduced in MATH 415 including Galois Theory and the Sylow Theorems with emphasis on the theoretical aspects.  
Prerequisite: MATH 415; junior or senior classification.

MATH 417 Numerical Methods  
Credits 4. 3 Lecture Hours. 3 Lab Hours.  
Numerical methods for applications; qualitative discussion of convergence and stability properties; computer implementation; interpolation and quadrature, initial value problems, matrix decompositions, interactive solution of linear and non-linear systems, least squares approximation, boundary value problems for ordinary differential equations.  
Prerequisites: MATH 304, MATH 309, MATH 311, or MATH 323; MATH 308; ability to program; junior or senior classification.

MATH 419 Applications of Actuarial Science  
Credits 2. 2 Lecture Hours.  
Applications of actuarial science using mathematical and statistical methods to assess risk in the insurance and finance industries; emphasis on probability, statistics, finance and economics; focus on using probabilistic models in the estimation of insurance premiums.  
Prerequisite: MATH 411 or STAT 414 or approval of math advisor.

MATH 420 Application of Actuarial Science II  
Credits 2. 2 Lecture Hours.  
Use of mathematical and statistical methods to price various financial instruments, such as bonds; understanding how the term structure of interest rates affect the price of these instruments.  
Prerequisite: MATH 325 or concurrent enrollment, or approval of instructor.
MATH 423 Linear Algebra II
Credits 3. 3 Lecture Hours.
Eigenvalues, similarity and canonical forms, advanced topics to be chosen by the instructor.
Prerequisites: MATH 220 or CSCE 222/ECEN 222; MATH 304 or MATH 323, or approval of instructor.

MATH 425 The Mathematics of Contingent Claims
Credits 3. 3 Lecture Hours.
The mathematical theory associated with asset price dynamics; binomial pricing models; Black-Scholes analysis; hedging; volatility smile; implied volatility trees; implied binomial trees.
Prerequisites: MATH 308; MATH 411, STAT 211 or STAT 414.

MATH 427 Introduction to Number Theory
Credits 3. 3 Lecture Hours.
Prime and composite integers; Euclidean algorithm; modular arithmetic; Chinese remainder theorem; unique factorization; quadratic reciprocity; Riemann zeta function; representation of numbers as a sum of squares.
Prerequisites: MATH 220; MATH 304 or MATH 323.

MATH 431 Structures and Methods of Combinatorics
Credits 3. 3 Lecture Hours.
Enumerative techniques generating functions, partially ordered sets, elementary graph theory, elementary Ramsey theory.
Prerequisite: MATH 220 or MATH 302 or approval of instructor.

MATH 433 Applied Algebra
Credits 3. 3 Lecture Hours.
An introduction to groups, rings, fields with emphasis on modular arithmetic; applications to number theory, coding theory, and other areas.
Prerequisites: MATH 220 or MATH 302; MATH 304 or MATH 323.

MATH 436 Introduction to Topology
Credits 3. 3 Lecture Hours.
Metric spaces; continuity of metric spaces; topological spaces; basic notions; separation axioms; compactness; local compactness; connectedness; basic notions in homotopy theory; quotient spaces, paracompactness and topological manifolds.
Prerequisites: MATH 220; MATH 221, MATH 251, or MATH 253.

MATH 437 Principles of Numerical Analysis
Credits 4. 3 Lecture Hours.
Mathematical principles of numerical analysis and their application to the study of particular methods; fixed-point iteration, Newton’s method; normed vector spaces and operators, Schur decomposition, convergent matrices, minimization methods, conjugate gradient method; polynomial interpolation of Lagrange and Hermite; best approximation, Bernstein and Weierstrass Theorems, numerical quadrature.
Prerequisites: MATH 304, MATH 309, MATH 311, or MATH 323; MATH 308; MATH 409; ability to program; junior or senior classification.

MATH 439 Differential Geometry of Curves and Surfaces
Credits 3. 3 Lecture Hours.
Local and global theory of parameterized curves; regular surfaces, local coordinates, first fundamental form, orientation, area; Gauss map, second fundamental form; Gauss Bonnet theorem; additional topics to be selected by the instructor.
Prerequisites: MATH 308; MATH 304 or MATH 323.

MATH 442 Mathematical Modeling
Credits 3. 3 Lecture Hours.
The construction of mathematical models from areas such as economics, game theory, integer programming, mathematical biology and mathematical physics.
Prerequisites: MATH 304, MATH 309, MATH 311, or MATH 323; MATH 308 or equivalent.

MATH 446 Principles of Analysis I
Credits 3. 3 Lecture Hours.
Construction of the real and complex numbers; topology of metric spaces, compactness and connectedness; Cauchy sequences, completeness and the Baire Category Theorem; Continuous Mappings; introduction to Point-Set Topology.
Prerequisites: MATH 409; junior or senior classification.

MATH 447 Principles of Analysis II
Credits 3. 3 Lecture Hours.
Riemann-Stieljes integration; sequences and series of functions; the Stone-Weierstrass and Arzela-Ascoli Theorems; introduction to Lebesgue measure theory and integration.
Prerequisites: MATH 446 or approval of instructor; junior or senior classification.

MATH 450 Tensors and General Relativity
Credits 3. 3 Lecture Hours.
Vectors and tensors in special relativity, curvature, manifolds, covariant differentiation, Einstein field equations, Schwarzschild geometry and black holes, cosmology, gauge field theories.
Prerequisites: MATH 308; PHYS 331 or MATH 323 or MATH 311; junior or senior classification.

MATH 460 Modern Geometry
Credits 3. 3 Lecture Hours.
Modern development of Euclidean geometry (Hilbert axioms) with historical and philosophical context; independence of the parallel postulate; models of hyperbolic non-Euclidean geometry.
Prerequisite: MATH 304, MATH 309, MATH 311, MATH 323 or MATH 220.

MATH 462 Introduction to Mathematical Biology
Credits 3. 3 Lecture Hours.
Introduction to mathematical modeling techniques in the biological sciences; continuous versus discrete models; deterministic versus stochastic models; includes population dynamics and ecology, spread of infectious diseases, population genetics and evolution, spatial pattern formation.
Prerequisites: MATH 304 or MATH 323; MATH 308 or equivalent.

MATH 467 Modern Geometry
Credits 3. 3 Lecture Hours.
Modern development of Euclidean geometry (Hilbert axioms) with historical and philosophical context; independence of the parallel postulate; models of hyperbolic non-Euclidean geometry.
Prerequisite: MATH 304, MATH 309, MATH 311, MATH 323 or MATH 220.

MATH 470 Communications and Cryptography
Credits 3. 3 Lecture Hours.
Introduction to coded communications, digital signatures, secret sharing, one-way functions, authentication, error control and data compression.
Prerequisites: MATH 304 or MATH 309 or MATH 311 or MATH 323; CSCE 110 or CSCE 111 or CSCE 121 or CSCE 206 or ENGR 112; approval of instructor.

MATH 471 Communications and Cryptography II
Credits 3. 3 Lecture Hours.
Additional topics in coded communications; information and entropy, elliptical curves, error corrections, quantum methods.
Prerequisites: MATH 470 or consent of instructor.
MATH 482 Research Seminar
Credits 3. 3 Lecture Hours.
Problems, methods and recent developments in mathematics, with emphasis on projects, and written and oral presentations. May be repeated for credit.
Prerequisites: MATH 409 or MATH 415 (may be taken concurrently); junior or senior classification; approval of instructor.

MATH 485 Directed Studies
Credits 1 to 8. 1 to 8 Other Hours.
Special problems in mathematics not covered by any other course in the curriculum. Work may be in either theory or laboratory.
Prerequisite: Approval of department head.

MATH 489 Special Topics in...
Credits 1 to 4. 1 to 4 Lecture Hours.
Selected topics in an identified area of mathematics. May be repeated for credit.
Prerequisite: Approval of instructor.

MATH 490 The Putnam Challenge
Credit 1. 1 Lecture Hour.
Intensive individualized training for preparation for the Putnam Exam, a national contest for mathematics majors. May be taken four times for credit.
Prerequisites: Approval of instructor; junior or senior classification.

MATH 491 Research
Credits 0 to 3. 0 to 3 Other Hours.
Active research of basic nature under supervision of Department of Mathematics or affiliated department graduate faculty member; a maximum of 6 hours of credit can be used in degree plans. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded.
Prerequisites: Mathematics or applied mathematical sciences major; junior or senior classification or approval of mathematics advisor.